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EDMUNDS, JAMES, M.D., L.R.C.P. Edin., M.R.C.S. Eng., L.S.A., 4, Fitzroy-square, W.
EDWARDS, JOHN, M.D., M.R.C.S. Eng., Sparkbrook, Birmingham.
ELLIOTT, GEORGE S., M.D., L.S.A., Southwell, Notts.
ELLIS, EDWARD, M.D., M.R.C.S. Eng., M. & L.S.A., Phys. Victoria Hosp. for Child. and Samarit. Hosp. for Wom. and Child., 118, Warwick-street, Belgravia, S.W.
ERSKINE, WILLIAM, M.D., L.F.P.S. Glasg., Kincardine, Perthshire.
EVANS, NICHOLL, M.D., M.R.C.S. Eng., Cheshunt, Herts.
EVERS, CHARLES, M.D., M.R.C.S. Eng., L.S.A., St. Austin's Mount, Grassendale, Liverpool.
FAIRLESS, W. DEAN, M.D., M.R.C.S. Eng., Longdales, Bothwell, N.B.
FARQUHARSON, DUNCAN, M.D., L.R.C.P. Edin., L.R.C.S. Edin., Tillicoultry, Stirling.
FAWCUS, HENRY R., M.D., M.R.C.S. Eng.,L.S.A., Flodden Lodge, Ford, Coldstream, N.B.
FEGAN, RICHARD, M.D., L.K.Q.C.P. Irel., L.R.C.S.I., L.M. Dub., Charlton, Kent.
FENTON, JOHN, M.D., L.R.C.P. Edin., F.R.C.S. Eng., L.S.A., 16, Mornington-terrace, Liverpool.
FINCH, ROBERT, M.D., M.R.C.S. Eng., L.S.A., Med. Off. of Health for Charlton, Blackheath, S.E.
FISHER, LUKE, M.D., M.R.C.S. Eng., L.S.A., Lytham, Preston, Lancashire.
FLEMING, HANS, M.D., L.R.C.S.I., L.M., Omagh, Co. Tyrone.
FLETCHER, JOHN S., M.D., M.R.C.S. Eng., L.S.A., 8, Lever-street, Manchester.
FOOTE, C. N., M.D., M.R.C.S. Eng., L.S.A., 8, Chester-road, Bishopwearmouth, Sunderland.
FORD, JAMES, M.D., M.R.C.S. Eng., L.S.A., Chulmleigh, North Devon.
FOX, CHARLES H., M.D., M.R.C.S. Eng., The Beeches, Brislington, Bristol.
FOX, LUTHER O., M.D., L.R.C.P. Edin., F.R.C.S. Eng., L.S.A., Broughton, Winchester.
FRAIN, JOSEPH, M.D., L.R.C.P. Edin., M.R.C.S. Eng., L.S.A., Hon. Surg. South Shields and Westoe Disp., Frederick-street, South Shields.
GARDEN, J., M.D., 4, Clifton-road, St. John's Wood, N.W.
GARDINER, WILLIAM S., M.D., M.R.C.S. Eng., L.A.H. Dub., L.M., Workhouse, Cork.
GARDINER, GIDEON G., M.D., M.R.C.S. Eng., Brooke-house Private Lunatic Asylum, Upper Clapton, N.E.
GARSTANG, WALTER, M.D., L.R.C.P. Lond., L.R.C.P. Edin., F.R.C.S. Edin., L.M., 2, France-street, Blackburn.
GEDDES, JOHN, M.D., L.R.C.S. Edin., 37, Union-place, Aberdeen.
GEORGE, FREDERICK, M.D., M.R.C.S. Eng., Birch Lodge, Ross, Herefordshire.
GILES, GEORGE F., M.D., M.R.C.S. Eng., L.S.A., Springfield-road, St. Leonard's-on-Sea.
GILL, JOHN B., M.D., M.R.C.S. Eng., L.S.A., 4, Camden-crescent, Dover.
GODDARD, R. WALTER, M.D., M.R.C.S. Eng., L.M., L.S.A., 107, Edgware-road, W.
GODFREY, BENJAMIN, M.D., M.R.C.S. Eng., L.S.A., F.R.A.S., Carlton House, Enfield, Middlesex.
GODWIN, ASHTON, M.D., L.R.C.P. Lond., M.R.C.S. Eng., L.M., L.S.A., 11, Pelham-crescent, Brompton, S.W.
GOLDER, JAMES, M.D., L.R.C.S. Edin., 101, Crown-street, Glasgow.
GOLDSMITH, JOHN, M.D., M.R.C.S. Eng., L.S.A., Worthing, Sussex.
GOODDAY, HORATIO, M.D., M.R.C.S. Eng., L.S.A., M.S.A., 66, Kensington-park-road, W.
GOODMAN, CHARLES R., M.D., M.R.C.S. Eng., L.S.A., 205, York-st., Cheetham, Manchester.
GORDON, C. A., M.D., L.R.C.S. Edin., C.B., Dep. Insp.-Gen. Army Hosp., Portsmouth.
GOSS, S. DAY, M.D., L.R.C.P. Edin., F.R.G.S., 111, Kennington-park-road, S.E.
GOYDER, DAVID, M.D., L.R.C.S. Edin., 28, Horton-road, Bradford, Yorkshire.
GRAMSHAW, JAMES H., M.D., M.R.C.S. Eng., L.S.A., Surg. Infirm. and Disp., 25, King-street, Gravesend.
GRAVES, FREDERICK G., M.D., M.R.C.S. Eng., L.S.A., 14, Chichester-road, W.
GRAY, THOMAS S., M.D., M.R.C.S. Eng., L.S.A., Lansdowne House, 340, Essex-road, N.
GREENHALGH, ROBERT, M.D., M.R.C.P. Lond., M.R.C.S. Eng., Phys. Acc. and Lect. on Dis. of Wom. and Children, St. Barthol. Hosp., Cons. Phys. Acc. City of Lond. Lying-in Hosp., Cons. Phys. Samarit. Hosp. for Wom. and Child., 72, Grosvenor-street, W.
GREENWELL, BAKER, M.D., M.R.C.S. Eng., L.S.A., 49, New Finchley-road, N.W.
GREENWOOD, MAJOR, M.D., M.R.C.S. Eng., L.M., L.S.A., 26, Queen's-road, Dalston, N.E.
GRIFFITH, JOHN T., M.D., F.R.C.S. Eng., L.S.A., Talfourd House, Camberwell, S.
GRIFFITH, S., M.D., M.R.C.S. Eng., L.S.A., Portmadoc, Carnarvon.
GRIFFITHS, EDWIN T., M.D., L.F.P.S. Glasg., L.M., L.S.A., Grove House, Vauxhall-road, Birmingham.
GRIFFITHS, FRANCIS T., M.D., M.R.C.S. Eng., L.M., L.S.A., B.L. Univ. France, F.S.A., Lect. on Phys. and Path. Anat. Sheffield Med. Sch., 12a, Surrey-street, Sheffield.

GROVE, WILLIAM R., M.D., M.R.C.S. Eng., L.S.A., Med. Off. of Health, St. Ives, Hunts.
GWYNN, S. TAYLEUR, M.D., M.R.C.S. Eng., L.S.A., Whitchurch, Salop.
HALL, EGERTON F., M.D., L.R.C.P. Edin., M.R.C.S. Eng., The Ash Trees, Prescot, Lancash.
HARCOURT, GEORGE, M.D., F.R.C.S. Eng., L.S.A., Chertsey, Surrey.
HARDING, CHARLES F., M.D., M.R.C.S. Eng., Whittlesea, Cambridgeshire.
HARLAND, HENRY, M.D., M.R.C.S. Eng., L.S.A., L.M. Glasg., Mayfield, Sussex.
HARPER, HENRY L., M.D., M.R.C.S. Eng., L.S.A., Sussex House, Hammersmith.
HARRIS, CHARLES, M.D., M.R.C.S. Eng., L.S.A., Northiam, Sussex.
HARRISON, A. R., M.D., M.R.C.P. Edin., M.R.C.S. Eng., L.S.A., Pembroke House, Hackney, N.E.
HARRISON, CHARLES, M.D., M.R.C.S. Eng., L.S.A., Surg. Lincoln Gen. Disp., Med. Off. of Health, Castle-hill, Lincoln.
HARRISON, J. BOWER, M.D., M.R.C.P. Lond., F.R.C.S. Eng., L.S.A., Higher-Broughton, Manchester.
HARRISON, WILLIAM, M.D., L.R.C.P. Edin., M.R.C.S. Eng., L.M., L.S.A., Gargrave, Leeds.
HASSALL, RICHARD, M.D., Ext. L.R.C.P. Lond., M.R.C.S. Eng., L.S.A., Richmond, Surrey.
HAYDON, N. J., M.D., L.R.C.P. Edin., M.R.C.S. Eng., L.S.A., Bovey Tracey, Devon.
HAYWARD, GEORGE, M.D., M.R.C.S. Eng., L.S.A., 7, South-parade, Leeds.
HAYWARD, JOHN W., M.D., M.R.C.S. Eng., L.S.A., 117, Grove-street, Liverpool.
HAYWARD, SIDNEY, M.D., M.R.C.S. Eng., L.S.A., Phys. Victoria Hosp. for Children and Samaritan Hosp., 4, Hobart-place, Eaton-square, S.W.
HEAD, THOMAS, M.D., F.R.C.P. Edin., M.R.C.S. Eng., L.S.A., Scotby, Carlisle.
HEARDER, GEORGE J., M.D., L.R.C.S. Edin., Med. Supt. Joint Counties Asyl., Carmarthen.
HECKSHER, MARTIN, M.D., M.D. Berlin, M.R.C.P. Lond., 245, Oxford-road, Manchester.
HELSHAM, H., M.D., F.R.C.S. Eng., L.M., L.S.A., 4, Park-place, Brixton-road, S.W.
HENDERSON, JOHN, M.D., F.R.C.S. Edin., Surg. Leith Hosp., 7, John's-place, Leith.
HENDERSON, WILLIAM, M.D., L.M. Edin., 17, Rose-terrace, Perth.
HENRY, ALEXANDER, M.D., M.R.C.S. Eng., L.S.A., 16, Gt. Coram-street, Russell-sq., W.C.
HENSLEY, HENRY, M.D., M.R.C.S. Eng., L.S.A., Surg. Inst. for the Blind, Deaf, and Dumb, 15, Alfred Street, Bath.
HENTY, GEORGE, M.D., M.R.C.S. Eng., 34, Hilldrop-road, Tufnell-park, N.
HETLEY, FREDERIC, M.D., F.R.C.S. Eng., L.S.A., L.M., Norbury Lodge, Upper Norwood, Surrey.
HIGGINS, CHARLES H., M.D., M.R.C.P. Lond., F.R.C.S. Eng., L.S.A., Alfred House, Birkenhead.
HIGHMORE, NATHANIEL J., M.D., M.R.C.S. Eng., L.S.A., Bradford-on-Avon.
HIGHMORE, WILLIAM, M.D., M.R.C.S. Eng., L.S.A., Sen. Phys. and Surg. Yeatman Hosp., Sherborne, Dorsetshire.
HILL, JOHN D., M.D., F.R.C.S. Eng., L.S.A., Surg. Roy. Free Hosp., Assist. Surg. Roy. Orthopædic Hosp., 17, Guilford-street, W.C.
HILL, SAMUEL, M.D., L.R.C.P. Edin., L.R.C.S.I., L.S.A., L.M., 22, Mecklenburgh-sq., W.C.
HODGSON, ROBERT W., M.D., L.R.C.P. Edin., M.R.C.S. Eng., L.S.A., Northallerton, Yorkshire.
HODGSON, WILLIAM J., M.D., M.R.C.S. Eng., L.S.A., Long Sutton, Wisbeach, Lincolnsh.
HOLCOMBE, CHARLES A., M.D., M.R.C.S. Eng., L.S.A., 29, South-hill-road, Liverpool.
HOLMAN, C., M.D., M.R.C.S. Eng., L.S.A., Reigate, Surrey.
HOLMAN, HENRY M., M.D., F.R.C.S. Eng., L.S.A., Hurstpierpoint, Sussex.
HOOD, PETER, M.D., L.S.A., 15, Lower Seymour-street, W.
HOOD, WHARTON P., M.D., M.R.C.S. Eng., L.S.A., 65, Upper Berkeley-st., Portman-sq., W.
HOWARD, JAMES F., M.D., M.R.C.S. Eng., L.S.A., Shaw, Lancashire.
HUBERT, T. K., M.D., M.R.C.S. Eng., L.S.A., Billingshurst, Sussex.
HUGHES, JAMES S., M.D., L.R.C.S.I., L.M., L.A.H. Dub., 77, Roscommon-street, Liverpool.
HUGHES, ROBERT, M.D., M.R.C.S. Eng., L.S.A., L.M., Conway, Carnarvon.
HULME, JAMES D., M.D., M.R.C.S. Eng., L.S.A., Great Wigston, Leicester.
HUMBY, EDWIN, M.D., M.R.C.S. Eng., L.S.A., 83, Hamilton-terr., St. John's-wood, N.W.
HUNT, BENJAMIN, M.D., M.R.C.S. Eng., L.S.A., Surg. Birm. Eye and Ear Hosp., 49, Broad-street, Birmingham.
HUTCHISON, WILLIAM, M.D., L.F.P.S. Glasg., L.M., Loughborough, Leicestershire.
ILES, F. H. WILSON, M.D., M.R.C.S. Eng., L.M., L.S.A., Watford, Herts.
INGHAM, AMOS, M.D., M.R.C.S. Eng., L.S.A., Keighley, Yorkshire.
IRWIN, WILLIAM C., M.D., M.R.C.P. Lond., L.R.C.P. Edin., M.R.C.S. Eng., L.S.A., Belvoir-street, Leicester.
IRWIN, WILLIAM R., M.D., L.R.C.P. Lond., L.R.C.S. Irel., L.M., Monaghan, Ireland.
JACKSON, J. HUGHLINGS, M.D., F.R.C.P. Lond., M.R.C.S. Eng., Phys. Lond. Hosp., Lect. on Physiol. Lond. Hosp. Med. Coll., Phys. Hosp. for Epilepsy and Paralysis, 28, Bedford-place, Russell-square, W.C.
JAMES, ALFRED, M.D., M.R.C.S. Eng., L.S.A., Perry Vale, Forest Hill, Kent.
JAMES, M. PROSSER, M.D., M.R.C.P. Lond., M.R.C.S. Eng., L.M., L.S.A., Sen. Phys. City Disp., 18, Dover-street, Piccadilly, W.

JEFFERY, GEORGE AUGUSTUS, M.D., M.R.C.S. Eng., L.S.A., Phys. Conv. Hosp., Trinity House, Eastbourne.

JENCKEN, FERDINAND E., M.D., M.R.C.P. Lond., L.M., 27, Adelaide-street, Kingstown, Co. Dublin.

JENNINGS, ROBERT, M.D., L.S.A., L.R.C.S. Edin., L.M., Dunster, Somersetshire.

JEPHCOTT, SAMUEL T., M.D., M.R.C.S. Eng., L.S.A., 86, Foregate-street, Chester.

JEPSON, O., M.D., M.R.C.S. Eng., L.S.A., Med. Superint. City of London Lunat. Asyl., Stone, Dartford, Kent.

JOHNSON, HORACE E., M.D., L.R.C.P. Edin., L.S.A., 8, Ovington-square, Brompton, S.W.

JONES, EDWARD, M.D., B.L. Univ. France, M.R.C.S. Eng., L.S.A., Surg. Sydenham Disp., The Park, Sydenham, Kent.

JONES, PODMORE W. H., M.D., M.R.C.S. Eng., L.S.A., F.L.S., 68, Harley-street, W.

JONES, THOMAS, M.D., M.R.C.S. Eng., L.S.A., Phys. Ross Disp., 8, Church-street, Ross, Herefordshire.

JONES, WALTER, M.D., M.R.C.S. Eng., L.M., L.S.A., Surg. Western City Disp., 45, Finsbury-square, E.C.

JONES, W. GOODALL, M.D., M.R.C.S. Eng., L.M., L.S.A., 6, Prince Edwin-street, Liverpool.

KEALY, JOHN R., M.D., M.R.C.S. Eng., L.S.A., Surg. Portsmouth, Portsea, and Gosport Hosp., Ashley House, Gosport.

KEILLER, ALEXANDER, M.D., F.R.C.P. Edin., L.R.C.S. Edin., F.R.S. Edin., Phys. Roy. Matern. Hosp. and Hosp. for Sick Child., Phys. Acc. Roy. Pub. Disp. Edin., Lect. on Midw. and Dis. of Women and Child., Surg. Hall Edin., Exam. in Midw. Univ. St. And., 21, Queen-street, Edinburgh.

KERNOT, C. M., M.D., M.R.C.S. Eng., L.M., Chrisp-street, Poplar, E.

KERSEY, ROBERT C., M.D., M.R.C.S. Eng., L.S.A., Littlebourne, Wringham, Kent.

KINAHAN, —, M.D., Carrick-on-Suir, Co. Tipperary.

KING, THOMAS K., M.D., M.R.C.S. Eng., L.S.A., L.A.H. Dub., 23, Addington-place, Camberwell, S.

KINGSFORD, CHARLES D., M.D., M.R.C.S., Eng., L.S.A., Surg. Lond. Orph. Asyl. Clapton, Surg. Roy. Brit. Asyl. for Deaf and Dumb Females, Upper Clapton, N.E.

KITCHING, JOHN, M.D., L.R.C.P. Edin., M.R.C.S. Eng., L.S.A., The Friends' Retreat, York.

LAKE, WILLIAM C., M.D., M.R.C.S. Eng., L.S.A., Surg. Teignmouth, Dawlish, and Newton Infirm., Teignmouth, Devon.

LAWLOR, JEREMIAH, M.D., L.R.C.P. Edin., L.F.P.S. Glasg., L.M., L.A.H. Dub., Phys. Queenstown Fev. and Gen. Hosp., Queenstown, Co. Cork.

LAWRENCE, SAMUEL, M.D., L.R.C.S. Edin., Montrose.

LEE, HERBERT G., M.D., A.A. Oxon., M.R.C.S. Edin., L.S.A., Thame, Oxon.

LEE, MATTHEW, M.D., M.R.C.S. Eng., St. Andrew's-villas, Lister-hills, Bradford, Yorkshire.

LEONARD, PETER, M.D., M.R.C.P. Lond., L.R.C.S. Edin., Insp.-Gen. Hosps. and Fleets, Plaisaunce, Upper Norwood, S.

LINDSAY, J. MURRAY, M.D., L.R.C.S. Edin., L.S.A., Med. Superint. Female Depart. Middlesex Co. Asyl., Hanwell.

LIPSCOMB, J. T. N., M.D., F.R.C.S. Eng., L.S.A., Surg. Gen. Disp., St. Albans, Herts.

LISTER, BRYAN, M.D., M.R.C.S. Eng., L.S.A., Littleborough, Manchester.

LLOYD, EDWIN, M.D., M.R.C.S. Eng., L.S.A., 59, Bath-terrace, Worksop, Notts.

LLOYD, THOMAS, M.D., F.R.C.S. Eng., L.S.A., Norfolk Villa, West-hill, St. Leonards-on-Sea.

LONG, RICHARD, M.D., A.M. St. And., L.A.H. Dub., L.M., Phys. Camphill Fev. Hosp., Arthurstown, New Ross, Co. Wexford.

LUSH, J. A., M.D., M.R.C.P. Lond., M.R.C.S. Eng., L.S.A., M.P. for Salisbury, Fisherton House, Salisbury.

LYELL, DAVID, M.D., L.R.C.S. Edin., 23, Tay-street, Dundee.

LYNES, EDWARD, M.D., M.R.C.S. Eng., L.M., L.S.A., Surg. Coventry and Warwicksh. Hosp., 9, Priory-row, Coventry.

LYSTER, CHAWORTH E., M.D., L.R.C.S.I., L.M., L.S.A., Surg. Toxteth-pk. Fev. Hosp., 20, Belvidere-road, Prince's-park, Liverpool.

MACDONALD, JOHN D., M.D., M.R.C.S. Eng., F.R.S., Vine Cottage, Meryon-road, Charlton, E.

MACINTYRE, DUNCAN, M.D., L.R.C.S. Edin., Parade House, Fort William, Inverness-shire.

MACKENZIE, J., M.D., L.R.C.S. Edin., Staff Assist.-Surg. Army, Shorncliffe.

MACKIE, JAMES W. R., M.D., F.R.C.S. Edin., Cupar, Fifeshire.

MACKINDER, DRAPER, M.D., F.R.C.S. Edin., M.R.C.S. Eng., L.S.A., Gainsborough.

MACKINTOSH, ALEXANDER, M.D., L.F.P.S. Glasg., Phys. Supt. Roy. Lunat. Asylum, Gartnavel, Glasgow.

MACKINTOSH, CHARLES H., M.D., L.R.C.P. Lond., M.R.C.S. Eng., L.S.A., Morden Hall, Warren-road, Torquay.

MACLEOD, WILLIAM, M.D., F.R.C.P. Edin., L.R.C.S. Edin., Ben Rhydding, Otley, Yorksh.

MADDEN, LEWIS P., M.D., M.R.C.P. Lond., M.R.C.S. Eng., J.P., Jacobstowe, Exbourne, Devonshire.

MADGE, H. M., M.D., M.R.C.S. Eng., L.S.A., 32, Fitzroy-square, W.

MAGILL, MARTIN, M.D., F.R.C.S. Eng., R.N., 39, Chepstow-villas, Bayswater, W.
MAJOR, HARRY P., M.D., M.R.C.S. Eng., M. and L.S.A., High-street, Hungerford, Berks.
MANFORD, ROBERT A., M.D., F.R.C.S. Edin., L.F.P.S. Glasg., J.P. for Co. Inverness, 8, Ness Bank, Inverness.
MARSDEN, ALEXANDER, M.D., F.R.C.S. Edin., M.R.C.S. Eng., Surg. Roy. Free Hosp., Surg. Cancer Hosp., 65, Lincoln's-inn-fields, W.C.
MARSTON, CHARLES H., M.D., L.R.C.P. Edin., M.R.C.S. Eng., Phys. North Wilts Disp., 27, Long-street, Devizes, Wilts.
MARTIN, FREDERICK, M.D., M.R.C.S. Eng., L.S.A., Phillimore House, Beckenham, Kent, S.E.
MARTIN, THOMAS, M.D., M.R.C.S. Eng., L.S.A., Pendlebury, Manchester.
MASSEY, ISAAC, M.D., L.R.C.P. Edin., F.R.C.S. Eng., L.S.A., Surg. Nottingham Co. Gaol, Cons. Surg. Nottingham Disp., Wellington-circus, Nottingham.
MATTHEWS, JOHN, M.D., L.S.A., Phys. Lond. Female Peniten. Pentonville, 4, Mylne-street, E.C.
MAUGHAM, WILLIAM, M.D., M.R.C.S. Eng., L.S.A., L.M. Glasg., Northgate House, Carnarvon.
MAUND, HENRY, M.D., M.R.C.S. Eng., L.S.A., Sandown, Isle of Wight.
MAY, HERMAN S., M.D., M.R.C.S. Eng., Summerlands, Exeter.
McCONVILLE, JOHN, M.D., L.R.C.S. Edin., 476, Argyll-street, Glasgow.
McEWEN, WILLIAM, M.D., M.R.C.P. Lond., L.R.C.S. Edin., Surg. Chester Castle, 27, Nicholas-street, Chester.
McGOWN, JOHN, M.D., L.F.P.S. Glasg., Millport, Isle of Cumbræ, N.B.
McINTYRE, JOHN, M.D., L.R.C.S. Edin., L.S.A., Odiham, Hants.
McLEAN, HUGH, M.D., M.R.C.S. Eng., L.S.A., Corbridge, Northumberland.
MELLER, CHARLES M., M.D., M.R.C.S. Eng., L.S.A.
MENZIES, WILLIAM, M.D., F.R.C.S. Edin., 3, Lothian-road, Edinburgh.
MERRYWEATHER, HENRY, M.D., M.R.C.S. Eng., Lect. on Dent. Surg. Sheffield Sch. of Med., 17, Howard-street, Sheffield.
MILES, EDWIN J., M.D., M.R.C.S. Eng., L.S.A., Gillingham, Dorsetshire.
MILLER, CLAUDIUS M., M.D., L.R.C.P. Edin., M.R.C.S. Eng., L.S.A., Claremont Villa, Stoke Newington-road, N.E.
MILLS, W. PARTRIDGE, M.D., L.R.C.P. Lond., M.R.C.S. Eng., L.S.A., Ipswich.
MINTER, JOHN M., M.D., F.R.C.S. Eng., L.S.A., Dep. Insp.-Gen. Hosps. and Fleets, Denbigh Lodge, Southsea, Hants.
MOFFAT, THOMAS, M.D., L.R.C.S. Edin., F.R.A.S., F.G.S., Hawarden, Flintshire.
MOON, HENRY, M.D., M.R.C.P. Lond., M.R.C.S. Eng., L.S.A., Phys. Sussex Co. Hosp., 9, Old Steyne, Brighton.
MOORE, DANIEL, M.D., M.R.C.S. Eng., L.S.A., 3, Wellington-square, Hastings.
MOORE, GEORGE, M.D., M.R.C.P. Lond., M.R.C.S. Eng., L.S.A., Hastings.
MOORE, GEORGE, M.D., M.R.C.S. Eng., L.S.A., Phys. Hartlepool Hosp., Hartlepool, Durham.
MORGAN, SAMUEL, M.D., M.R.C.S. Eng., L.S.A., 46, Rivers-street, Bath.
MORGAN, WILLIAM W., M.D., M.R.C.S. Eng., L.S.A., Newport, Monmouthshire.
MORRIS, EDWIN, M.D., F.R.C.S. Eng., L.S.A., High-street, Spalding, Lincolnshire.
MOTT, CHARLES, M.D., M.R.C.S. Eng., L.S.A., Walton-on-Thames.
MURRAY, JOHN C., M.D., L.R.C.S. Edin., L.M., L.R.C.P. Edin., 20, Newgate-street, Newcastle-on-Tyne.
NASH, J. P., M.D., M.R.C.S. Eng., Surg. 63rd Regt.
NEAL, JAMES, M.D., M.R.C.S. Eng., L.S.A., Surg. Birmingham Lying-in Hosp., 85, Newhall-street, Birmingham.
NEEDHAM, FREDERICK, M.D., M.R.C.P. Edin., M.R.C.S. Eng., L.M., L.S.A., Res. Med. Superint. York Lunat. Asyl., Bootham, York.
NESFIELD, STEPHEN, M.D., M.R.C.S. Eng., L.S.A., Surg. St. Mary's Hosp., Richmond-place, Old Trafford, Manchester.
NICHOLAS, GEORGE E., M.D., M.R.C.S. Eng., L.M., L.S.A., Med. Off. of Health for Wandsworth, 4, Church-row, Wandsworth, S.W.
NICHOLLS, JAMES, M.D., L.R.C.P. Lond., L.R.C.P. Edin., M.R.C.S. Eng., L.M., L.S.A., Chelmsford.
NICHOLLS, JOHN F., M.D., M.R.C.S. Eng., Surg. Roy. Wilts Militia, Devizes.
NORRIS, RICHARD, M.D., M.R.C.S. Eng., Prof. Physiol. Queen's Coll. Birm., 2, Birchfield-road, Aston, Birmingham.
NORRIS, WILLIAM, M.D., L.S.A., Stourbridge, Worcestershire.
O'CONNOR, WILLIAM, M.D., M.R.C.S. Eng., L.S.A., Sen. Phys. Royal Free Hosp., 30, Upper Montagu-street, Montagu-square, W.
O'NEILL, EDWARD J., M.D., L.R.C.S.I., L.A.H. Dub., 27, North Earl-street, Dublin.
OSBORNE, HENRY, M.D., M.R.C.S. Eng., L.S.A., Phys. Islington Disp., 3, Gibson-square, Islington, N.
OSBORNE, JOHN, M.D., F.R.C.S. Eng., L.S.A., Bitterne, Southampton.

OWEN, HARVEY K., M.D., F.R.C.S. Eng., M. and L.S.A., Surg. South London Disp., 260, Clapham-road, S.

PAGE, ALEXANDER H., M.D., L.K.Q.C.P. Irel., M.R.C.S. Eng., Jun. Surg. Royal Albert Hosp., Hollins-grove, Lower Darwen, Lancashire.

PAGE, FREDERICK, M.D., F.R.C.S. Eng., L.S.A., Langston Lodge, Milton, Southsea, Hants.

PAINE, HENRY J., M.D., M.R.C.S. Eng., L.S.A., F.A.S.L., Phys. Glamorgansh. Infirm., Med. Off. of Health for Cardiff, 11, Crockherbtown, Cardiff.

PAINTER, R. BUDD, M.D., F.R.C.S. Eng., M. and L.S.A., 4, Beaufort-gardens, Brompton-road, S.W.

PARKER, WILLIAM, M.D., L.F.P.S. Glasg., L.S.A., Med. Off. of Health for Bermondsey, 133, Grange-road, Bermondsey, S.E.

PARRATT, JAMES, M.D., M.R.C.S. Eng., M. and L.S.A., Mem. Court of Exam. Apoth. Soc., Bruce Villa, Northumberland-park, Tottenham, N.

PART, JAMES, M.D., F.R.C.S. Eng., L.S.A., Surg.-Oculist to Artists' Ann. Fund, 89, Camden-road, N.W.

PAUL, JOHN H., M.D., M.R.C.P. Lond., F.R.C.P. Edin., F.R.C.S. Eng., L.S.A., Med. Superint., Camberwell House Asylum, S.E.

PEART, ROBERT S., M.D., M.R.C.S. Eng., L.S.A., 22, Dockwray-square, North Shields.

PERRY, MARTIN, M.D., L.R.C.P. Edin., M.R.C.S. Eng., L.M., L.S.A., Dep. Coroner for Worcestershire, High-street, Evesham, Worcester.

PHIPPS, GEORGE C., M.D., L.R.C.P. Edin., L.R.C.S.Edin., L.M., 246, Clairville, Oxford-road, Manchester.

PIKE, THELWELL, M.D., M.R.C.S. Eng., L.S.A., Weyhill, Andover, Hants.

POCOCK, WILLIAM, M.D., M.R.C.S. Eng., L.S.A., 1, St. John's-villas, Brixton, S.

POLLOCK, A. JULIUS, M.D., M.R.C.P. Lond., M.R.C.S. Eng., Assist. Phys. Charing Cross Hosp., Phys. Foundling Hosp., 21, Montague-place, Russell-square, W.C.

POWELL, JOSIAH T., M.D., L.R.C.P. Edin., M.R.C.S. Eng., L.S.A., 347, City-road, E.C.

POWER, ROBERT F., M.D., M.R.C.P. Lond., F.R.C.S.I., M.R.C.S. Eng., late Phys. Coombe Hosp., 71, Gloucester-place, Portman-square, W.

PRESTON, WILLIAM J., M.D., M.R.C.S. Eng., L.S.A., 42, Belsize-road, St. John's-wood, N.W.

PROCTER, WILLIAM, M.D., M.R.C.S.Eng., L.S.A., F.C.S., Surg. York Disp., 24, Petergate, York.

PYBURN, JAMES, M.D., L.R.C.P. Lond., M.R.C.S. Eng., L.S.A., 34, Prospect-street, Hull.

RAMSBOTHAM, JOSEPH M., M.D., M.R.C.S. Eng., L.S.A., 15, Amwell-street, E.C.

RANSOM, ROBERT, M.D., F.R.C.S. Eng., L.M., L.S.A., 5, Jesus-lane, Cambridge.

REED, G., M.D., M.R.C.S. Eng., L.S.A., Res. Med. Off. Roy. Infirm., Manchester.

RENSHAW, HERBERT S., M.D., L.R.C.P. Lond., L.F.P.S. Glasg., L.M., L.S.A., Sale Bridge House, Sale, Cheshire.

RICHARDSON, BENJAMIN W., M.A., M.D., F.R.C.P. Lond., F.R.S., Assessor of Gen. Council in Univ. Court., 12, Hinde-street, W.

RICHARDSON, EDWARD, M.D., M.R.C.S. Eng., L.S.A., New-road, Commercial-road-east, E.

RICHARDSON, WILLIAM, M.D., A.M. Aberd., M.R.C.P. Lond., 25, Gloucester-gardens, Hyde-park, W.

RICKETTS, CHARLES, M.D., M.R.C.S. Eng., L.S.A., F.G.S., 1, Price-street, Birkenhead.

ROBERTS, ANTHONY T., M.D., M.R.C.S. Eng., 11, Lamb's Conduit-street, W.C.

ROBERTS, DAVID LLOYD, M.D., M.R.C.P. Lond., M.R.C.S. Eng., L.S.A., Phys. St. Mary's Hosp. Manchester, 23, St. John-street, Manchester.

ROBERTS, JOHN, M.D., M.R.C.S. Eng., L.S.A., L.M. Dub., Talarvor, Criccieth, Carnarvon.

ROBERTSON, C. A. LOCKHART, M.D., M.D. Gonville and Caius Coll. Cantab., M.B. Oxon., F.R.C.P. Lond., F.R.C.P. Edin., L.R.C.S. Edin., Chancery Visitor of Lunatics.

ROBINSON, THOMAS, M.D., M.R.C.S. Eng., L.S.A., 35, Lamb's Conduit-street, W.C.

RODEN, WILLIAM, M.D., A.M., L.R.C.P. Edin., F.R.C.S. Eng., L.S.A., J.P., The Grange, Kidderminster.

ROE, JOHN W., M.D., M.R.C.S. Eng., L.M., L.S.A., Coroner for Ellesmere, Dep. Coroner Pimhill Dist. N. Div. Co. Salop, Ellesmere, Salop.

ROGERS, GEORGE, M.D., L.R.C.P. Lond., M.R.C.S. Eng., L.S.A., Longwood House, Long Ashton, Bristol.

ROGERS, JOSEPH, M.D., M.R.C.S. Eng., L.S.A., 33, Dean-street, W.

ROGERS, THOMAS L., M.D., M.R.C.P. Lond., M.R.C.S. Eng., L.M., Med. Supt. Co. Asyl., Rainhill, Lancashire.

ROODS, H. CROWHURST, M.D., M.R.C.S. Eng., Westham, Eastbourne, Sussex.

ROSE, H. COOPER, M.D., M.R.C.S. Eng., L.S.A., F.L.S., F.G.S., Surg. Hampstead Disp., High-street, Hampstead, N.W.

ROSS, ALEXANDER C., M.D., M.B. Mar. Coll. Aberd., L.R.C.S. Edin., Surg. 92nd Regt.

ROSS, GEORGE, M.D., L.R.C.P. Edin., M.R.C.S. Eng., L.S.A., 11, Hart-st., Bloomsbury, W.C.

ROSS, JAMES J., M.D., L.R.C.S. Edin., Med. Att. Northern Infirm., Cons. Phys. Inverness Dist. Asyl., 65, Church-street, Inverness.

ROWEN, FREDERICK J., M.D., M.R.C.S. Eng., L.M. Dub., Annagurra House, Ballylanders, Co. Limerick.

ROYLE, OCTAVIAN N., M.D., F.R.C.S. Eng., Milnthorpe, Westmoreland.

ROYLE, PETER, M.D., L.R.C.P. Edin., M.R.C.S. Eng., L.S.A., J.P., Vernon Lodge, Sale, Manchester.

ROYSTON, CHARLES, M.D., L.R.C.P. Edin., M.R.C.S. Eng., L.M., L.S.A. 1, St. Stephen's-crescent, Westbourne-park, W.

SADLEIR, W., M.D., L.R.C.S.I., L.M., 21, Water-street, Liverpool.

SANDERSON, HUGH J., M.D., M.R.C.P. Lond., M.R.C.S. Eng., L.S.A., Phys. Hosp. for Wom., Soho-square, 26, Upper Berkeley-street, W.

SANDWITH, HUMPHRY, M.D., F.R.C.P. Lond., Cons. Phys. Hull Gen. Infirm., Beaconsfield, Bucks.

SANKEY, WILLIAM, M.D., M.R.C.S. Eng., L.S.A., Sutton-Valence, Staplehurst, Kent.

SARJANT, JOSIAH, M.D., L.R.C.P. Edin., M.R.C.S. Eng., L.M., West Ferry-road, Isle of Dogs, E.

SAVAGE, THOMAS, M.D., L.R.C.P. Lond., F.R.C.S. Eng., L.S.A., Prof. of Comp. Anat. Queen's Coll. Birmingham, Bordesley, Birmingham.

SAVORY, CHARLES T., M.D., M.R.C.S. Eng., L.S.A., 47, Mildmay-pk., Stoke Newington, N.

SAXBY, HENRY L., M.D., Baltasound, Shetland.

SCHOFIELD, FRANK, M.D., M.R.C.S. Eng., L.S.A., Asst. Phys. Camberwell House Lunatic Asylum, S.

SCOTT, WILLIAM, M.D., F.R.C.P. Edin., F.R.C.S. Eng., L.K.Q.C.P. Irel., L.M., Phys. Auchnacloy Fev. Hosp. and Disp., Auchnacloy, Co. Tyrone.

SCULLY, THOMAS, jun., M.D., L.R.C.S.I., L.A.H. Dub., L.M., Clonmel, Co. Tipperary.

SEALY, GEORGE J., M.D., M.R.C.S. Eng., L.S.A., Oatlands-park, Weybridge, Surrey.

SEATON, JOSEPH, M.D., F.R.C.P. Edin., Halliford House, Sunbury, Middlesex.

SEDGWICK, LEONARD W., M.D., M.R.C.S. Eng., L.S.A., 2, Gloucester-terrace, Hyde-pk., W.

SELWOOD, HENRY C., M.D., M.R.C.S. Eng., L.S.A., Hursley, Winchester.

SEMPLE, A., M.D., L.R.C.S. Edin., Staff Surg., Bombay.

SEMPLE, R. H., M.D., M.R.C.P. Lond., M.R.C.S. Eng., L.S.A., Phys. Eastern Disp., 8, Torrington-square, W.C.

SHARPLEY, THOMAS, M.D., M.R.C.S. Eng., L.S.A., County Coroner, Eastgate, Louth, Lincolnshire.

SHEEN, ALFRED, M.D., M.R.C.S. Eng., 61, Crockherbtown, Cardiff.

SHEPPARD, EDGAR, M.D., M.R.C.P. Lond., F.R.C.S. Eng., L.S.A., Med. Superint. Male Depart. Co. Asyl., Colney-Hatch, Middlesex.

SHETTLE, RICHARD C., M.D., M.R.C.S. Eng., L.S.A., London-street, Reading.

SHORTHOUSE, J. H., M.D., M.R.C.S. Eng., L.S.A., LL.D., The Grove, Carshalton, Surrey.

SIMPSON, THOS. PEMBERTON, M.D., M.R.C.S. Eng., L.M., L.S.A., Surg. Roy. Portsmouth Hosp., Wilton House, Southsea, Hants.

SKAE, FREDERICK W. A., M.D., F.R.C.S. Edin., Med. Superint. Stirling Dist. Asyl., Larbert, Falkirk, Stirlingshire.

SKINNER, THOMAS, M.D., L.R.C.S. Edin., L.M., Obst. Phys. Lying-in Hosp., Phys. Female Orph. Asyl. Liverp., 1, St. James-road, Liverpool.

SKRIMSHIRE, GEORGE, M.D., L.S.A., 68, Talbot-road, Westbourne-park, W.

SMITH, ALEXANDER M., M.D., M.R.C.S. Edin., Ibroxholm, Govan, Glasgow.

SMITH, JOSEPH, M.D., M.R.C.S. Eng., L.S.A., Phys. Warrington Disp., Friar's-green House, Warrington.

SMITH, J. SYDNEY, M.D., M.R.C.S. Eng., L.M., L.S.A., Surg. Tiverton Disp., Peter-street, Tiverton, Devon.

SMITH, M. BALL, M.D., M.R.C.S. Eng., L.M., L.S.A., Newent, Gloucestershire.

SMITH, SAMUEL W., M.D., M.R.C.S. Eng., L.M., L.S.A., Pershore, Worcestershire.

SMITH, T. BROWNING, M.D., West-End, Sittingbourne, Kent.

SOULBY, HENRY, M.D., L.R.C.P. Edin., M.R.C.S. Eng., L.S.A., Waverley House, Hull.

STAMPER, JAMES F., M.D., M.R.C.S. Eng., L.M., L.S.A., Bush-street, Pembroke Dock.

STAPLES, J. H. PROSSER, M.D., M.R.C.S. Eng., 65, Seymour-street, Connaught-square, W.

STEDMAN, JAMES R., M.D., F.R.C.S. Eng., L.S.A., Surg. Roy. Surrey Co. Hosp., Coroner for Borough, Guildford.

STEVENS, ROBERT, M.D., L.R.C.P. Lond., M.R.C.S. Eng., L.S.A., Christchurch, Hants.

STILES, HENRY T., M.D., M.R.C.S. Eng., L.M., L.S.A., Spalding, Lincolnshire.

STILWELL, ROBERT R., M.D., M.R.C.S. Eng., L.S.A., Beckenham, Kent.

STOCKER, ALONZO H., M.D., M.R.C.P. Lond., M.R.C.S. Eng., L.S.A., Phys. and Superint. Grove Hall Lunatic Asylum, Bow, E.

STOKOE, RICHARD, M.D., F.R.C.S. Eng., L.S.A., Cons. Phys. Peckham and Peckham-rye Disp., Peckham-rye, S.E.

STOVIN, CORNELIUS F., M.D., L.R.C.P. Edin., L.R.C.S., Wheatley, Oxon.

STUTTER, FREDERICK A., M.D., M.R.C.S. Eng., L.M., L.S.A., Farnbro' House, Upper Sydenham, Kent.

SULLIVAN, EDWARD W., M.D., M.R.C.S. Eng., L.S.A., L.M., Great Ilford, Essex.

SUTTON, WILLIAM, M.D., M.R.C.S. Eng., L.M., L.S.A., Camden-crescent, Dover.

TANNER, JOHN, M.D., L.R.C.P. Edin., M.R.C.S. Eng., L.S.A., L.F.P.S. Glasg., L.M., Alfred House, 118, Newington-causeway, S.E.

TANNER, THOMAS H., M.D., M.R.C.P. Lond., M.R.C.S. Eng., F.L.S., F.Z.S., 9, Henrietta-street, Cavendish-square, W.

TAYLER, WILLIAM H., M.D., M.R.C.S. Eng., L.M., L.S.A., Tudor House, Anerley, S.E.
TAYLOR, CHARLES, M D., M.R.C.S. Eng., L.S.A. Edin., Ex-Mem. Court of Exam. Apoth. Soc., Pine House, Camberwell-park, S.E.
TAYLOR, GEORGE, M.D., F.R.C.S. Eng., L.S.A., Phys. Derbysh. Gen. Infirm., 9, Friar-gate, Derby.
THOMAS, RICHARD R. G., M.D., L.R.C.P. Edin., M.R.C.S. Eng., L.M., Tiverton, Devon.
THOMSON, SPENCER, M.D., L.R.C.S. Edin., L.S.A., Ashton House, Torquay.
TIBBITS, JOHN, M.D., M.R.C.S. Eng., L.M., L.S.A., Jury-street, Warwick.
TIFFEN, ROBERT, M.D., M.R.C.S. Eng., L.S.A., Wigton, Cumberland.
TODD, JOHN M., M.D., M.R.C.S. Eng., L.S.A., Bognor, Sussex.
TORRY, JOHN C., M.D., M.R.C.P. Lond., Phys. Lincoln Co. Hosp. and Gen. Disp., Vis. Phys. Lincoln Lun. Asyl., Lincoln.
TREWHELLA, HENRY E., M.D., M.R.C.S. Eng., L.M., Headingley, Leeds.
TUKE, THOMAS HARRINGTON, M.D., F.R.C.P. Edin., M.R.C.P. Lond., M.R.C.S. Eng., 37, Albemarle-street, W.
TURNER, GEORGE B., M.D., M.R.C.S. Eng., L.S.A., Surg. East Sussex, Hastings, and St. Leonard's Infirm., 3, Warrior-square, St. Leonard's-on-Sea.
TURNER, ROGER, M.D., L.R.C.P. Edin., M.R.C.S. Eng., L.S.A., Surg. Petworth Gaol, Petworth, Sussex.
TURNOUR, HENRY E., M.D., M.R.C.S. Eng., L.S.A., Surg. Market Rasen Disp., Market Rasen, Lincolnshire.
TURTLE, FREDERICK, M.D., M.R.C.S. Eng., L.S.A., Clifton Lodge, Woodford, Essex.
TYLECOTE, JOHN H., M.D., L.R.C.S. Edin., L.M., L.S.A., Sandon, Stone, Staffordshire.
TYLEY, RICHARD P., M.D., M.R.C.S. Eng., L.S.A., Wedmore, Somerset.
TYTE, EDWARD C., M.D., M.R.C.S. Eng., L.S.A., Harrow-on-the-Hill, Middlesex.
USHER, THOMAS S., M.D., M.R.C.S. Eng., L.S.A., Lea Field House, Yeadon, Leeds.
VINCENT, JAMES, M.D., M.R.C.S. Eng., L.S.A., East Dereham, Norfolk.
VINE, G. J., M.D., F.R.C.S. Eng., L.S.A., 3, Henrietta-street, Covent-garden, W.C.
WALKER, GEORGE C., M.D., M.R.C.S. Eng., L.S.A., Bootle, Liverpool.
WALKER, JOSEPH, M.D., M.R.C.S. Eng., L.D.S., Dent. Surg. and Lect. Westminster Hosp., 22, Grosvenor-street, W.
WARD, JOHN, M.D., M.R.C.S. Eng., The Grange, Woodchester, Stroud, Gloucestershire.
WARING, EDWARD J., M.D., M.R.C.P. Lond., F.R.C.S. Eng., F.L.S., 39, Portsdown-gardens, Maida-hill, W.
WARNER, JOHN, M.D., M.R.C.S. Eng., L.M., L.S.A., 31, Weymouth-street, Portland-place, W.
WARWICK, WILLIAM R., M.D., M.R.C.S. Eng., L.S.A., Southend, Essex.
WATCHORN, ISAAC, M.D., Raleigh House, Raleigh-street, Nottingham.
WATKINS, EDWIN T., M.D., M.R.C.S. Eng., L.S.A., Surg. St. Pancras Prov. Disp., 61, Guilford-street, W.C.
WATSON, JOHN, M.D., L.R.C.P. Edin., M.R.C.S. Eng., L.M., L.S.A., 6, Southampton-street, Bloomsbury, W.C.
WEBB, WILLIAM, M.D., F.R.C.S. Eng., L.M., F.R.C.S. Edin., L.S.A., Gilkin View House Wirksworth, Derbyshire.
WEIR, ARCHIBALD, M.D., F.R.C.S. Edin., St. Mungho's, Great Malvern.
WELSH, JAMES, M.D., L.R.C.S. Edin., J.P., Kinghorn, Fifeshire, N.B.
WEST, R. UVEDALE, M.D., L.R.C.P. Edin., F.R.C.S. Edin., L.S.A., Alford, Lincolnshire.
WHITEHEAD, JOHN, M.D., M.R.C.S. Eng., L.S.A., Ventnor, Isle of Wight.
WHITMARSH, WILLIAM M., M.D., M.R.C.S. Eng., L.M., L.S.A., Dep. Coroner for Wilts, Hounslow, Middlesex.
WHITMORE, JOHN, M.D., M.R.C.S. Eng., L.S.A., Med. Off. Health for St. Marylebone, 15, Wimpole-street, W.
WIGHTMAN, WILLIAM, M.D., M.R.C.S. Eng., L.S.A., Phys. Halifax Infirm. and Gen. Disp., 1, Milton-place, Halifax, Yorkshire.
WILKINSON, FREDERIC E., M.D., L.R.C.P. Edin., M.R.C.S. Eng., L.S.A., F.R.G.S., Med. Off. Health Lewisham Dist., Battle Cottage, Sydenham, Kent.
WILKINSON, THOMAS, M.D., F.R.C.S. Irel., 28, Trinity-square, Brixton.
WILLETT, E. SPARSHALL, M.D., M.R.C.P. Lond., M.R.C.S. Eng., Wyke House, Syon-hill, Isleworth.
WILLETT, MATTHEW, M.D., M.R.C.S. Eng., Surg. Acc. Bristol Disp., Easton, Bristol.
WILLIAM, JOHN, M.D., M.R.C.S. Eng., L.S.A., Penygroes, Llanllyfni, Carnarvonshire.
WILLIAMS, A. WYNN, M.D., M.R.C.S. Eng., L.S.A., Phys. Samaritan Hosp., Phys. Acc. Western Gen. Disp., 1, Montagu-square, W.
WILLIAMS, C. RICE, M.D., L.R.C.P. Edin., M.R.C.S. Eng., L.S.A., Aberystwith, Cardigan.
WILLIAMS, DAVID W., M.D., M.R.C.S. Eng., Phys. West Norf. and Lynn Hosp., Kings Lynn, Norfolk.
WILLIAMS, EDWARD, M.D., M.R.C.S. Eng., L.S.A., Holt-street House, Wrexham.
WILLIAMS, JOHN, M.D., M.R.C.S. Eng., L.S.A., Trosnant Lodge, Pontypool, Monmouth.
WILLIAMS, JOHN, M.D., M.R.C.S. Eng., L.S.A., Swinton, Manchester.

WILLIAMS, S. W. DUCKWORTH, M.D., L.R.C.P. Lond., M.R.C.S. Eng., L.S.A., Asst. Med. Off. Co. Asyl., Hayward's-heath, Sussex.

WILLIAMS, WILLIAM J., M.D., F.F.P.S. Glasg., M.R.C.S. Eng., L.S.A., 231, Oldham-road, Manchester.

WILLIAMS, W. RHYS, M.D., L.K.Q.C.P. Irel., M.R.C.P. Edin., M.R.C.S. Eng., Bethlehem Hospital, S.E.

WILLIAMSON, JAMES, M.D., L.R.C.S. Edin., L.M., L.S.A., 44, Mildmay-park, N.

WILTSHIRE, ALFRED, M.D., M.R.C.P. Lond., Med. Insp. H.M. Privy Council, Sen. Phys. Islington Disp., 58, Queen Anne-street, Cavendish-square, W.

WISE, WILLIAM C., M.D., L.R.C.P. Lond., M.R.C.S. Eng., L.S.A., Plumstead, Kent.

WITHECOMBE, JOHN R., M.D., M.R.C.P. Lond., F.R.C.S. Eng., L.S.A., 3, Spring-terrace, Richmond, Surrey.

WOOD, HENRY B., M.D., M.R.C.S. Eng., L.S.A., Cranbrook, Kent.

WOODMAN, FREDERICK, M.D., L.R.C.P. Lond., M.R.C.S. Eng., Surg. Deal and Walmer Disp., Queen-street, Deal, Kent.

WOODMAN, W. BATHURST, M.D., M.R.C.S. Eng., L.M., M. & L.S.A., 10, Finsbury-pavement, E.C.

WOODWARD, WILLIAM, M.D., L.R.C.P. Lond., M.R.C.S. Eng., L.M., L.S.A., 22, Foregate-street, Worcester.

WOOLLAM, GEORGE, M.D., L.F.P.S. Glasg., Ashton-under-Lyne.

WRANGHAM, JOHN D., M.D., M.R.C.S. Eng., L.S.A., Wragby, Lincolnshire.

WYMAN, W. S., M.D., M.R.C.S. Eng., L.S.A., Hatfield Broad Oak, Essex.

WYNTER, ANDREW, M.D., M.R.C.P. Lond., 1, Bolton-road, Chiswick.

WYSE, GEORGE, M.D., L.A.H. Dub., L.M., Gov. of Apoth. Hall, Dub., 29, Upper Sackville-street, Dublin.

YELD, HENRY J., M.D., M.R.C.S. Eng., L.S.A., L.M. Glasg., Surg. Eye Infirmary, Surg. Gen. Infirmary, Bridge-street, Sunderland.

YELF, LEONARD K., M.D., M.R.C.S. Eng., L.S.A., Moreton-in-Marsh, Gloucestershire.

YOUNG, HENRY J., M.D., M.R.C.S. Eng., L.M., L.S.A., Bridgnorth, Shropshire.

ASSOCIATES.

BIRD, P. HINCKES, F.R.C.S. Eng., L.M., L.S.A., F.L.S., 1, Norfolk-square, London, W.

COLLINSON, ALFRED, M.D. Aberd., M.R.C.S. Eng., L.S.A., 19, Oxford-terr., Hyde-park, W.

DUNN, ROBERT W., M.R.C.S. Eng., M.S.A., Surg. Farringdon Disp., 13, Surrey-street, Strand, W.C.

FOX, TILBURY, M.D. Lond., M.R.C.P. Lond., Phys. Skin Dep. Univ. Coll. Hosp., 43, Sackville-street, W.

HAVILAND, ALFRED, M.R.C.S. Eng., L.S.A., 120, King Henry's-road, Primrose-hill, N.W.

HEARNDEN, WILLIAM A., M.D. & Ch.D. Brussels, L.R.C.P. Edin., L.F.P.S. Glasg., L.M., Sutton, Surrey.

HILL, R. GARDINER, L.R.C.P. Edin., M.R.C.S. Eng., L.S.A., Earl's Court House, Old Brompton, S.W.

KERNOT, GEORGE C., M.D. Alb., M.D. & D.Ph. Giess., L.D.S., L.S.A., Chrisp-street, Poplar, London, E.

KERSHAW, JOSEPH, M.R.C.S. Eng., 23, Byrom-street, Manchester.

KIERNAN, LAWRENCE, M.R.C.S., L.S.A., L.M., 46, Hall-gate, Doncaster.

LEWIS, HENRY, M.D. Bruss., M.R.C.S. Eng., L.S.A., Folkestone, Kent.

MARSHALL, PETER, M.R.C.S. Eng., L.S.A., late Pres. Med. Soc. Lond., 43, Bedford-square, London, W.

MILLAR, JOHN, L.R.C.P. Edin., L.R.C.S. Edin., Fell. Geol. Soc., F.L.S., Med. Superint. Bethnal House Asyl., Cambridge-road, London, N.E.

PALARGUE, J. A., M.R.C.S. Eng., Rochdale-road, Manchester.

PETTINGER, G. W., M.R.C.S. Eng., L.S.A., Sen. Surg. St. Mary's Hosp., 3, Trafford-street, Stretford New-road, Manchester.

REEVE, J. F., M.D. Aberd., M.R.C.S. Eng., L.S.A., 8, Sackville-street, W.

ROW, WILLIAM, M.R.C.S. Eng., L.S.A., Market Overton, Oakham, Rutland.

RUNCORN, HENRY, L.S.A., House Surg. St. Mary's Hosp., Manchester.

RUGG, GEORGE PHILIP, M.D. Aberd., L.R.C.P. Lond., M.R.C.S. Eng., L.M., L.S.A., Clapham-road, S.

SEDGWICK, JAMES, M.R.C.S. Eng., L.M., L.S.A., Boroughbridge, Yorkshire.

WHITEHEAD, WALTER, F.R.C.S. Edin., L.F.P.S. Glasg., L.M., L.S.A., Surg. St. Mary's Hosp., 234, Oxford-road, Manchester.

WHITEMAN, R. H., L.R.C.P. Edin., L.S.A., Med. Off. Health, Hotham House, Putney, Surrey.

HONORARY MEMBERS.

ADAMS, ROBERT, A.M., C.M., M.D. Dub., F.R.C.S. Irel., Regius Prof. of Surg. Trin. Coll. Dub., 22, St. Stephen's-green-north, Dublin.

ARGYLL, HIS GRACE THE DUKE OF. K.T., LL.D., F.R.S., Chancellor of the University of St. Andrews, Inverary Castle, Argyllshire.

BELCHER, VICE-ADMIRAL SIR EDWARD, K.C.B., 22a, Connaught-square, London, W.

BELL, OSWALD H., M.D., F.R.C.S. Ed., Prof. of Med. Univ. St. And.

BELL, REV. DAVID, M.A., M.D., C.M., Vicar of Goole, Yorkshire.

BILLING, ARCHIBALD, M.A., M.D. Oxon, F.R.C.P. Lond., F.R.S., F.G.S., 6, Grosvenor-gate, London, W.

BROWN, REV. WILLIAM, D.D., Prof. of Div. Univ. St. And., Manse of Gairloch, Dingwall, Ross-shire.

BROWN-SEQUARD, E., M.D., F.R.S., F.R.C.P. Lond., Professor Exp. Pathol. Univ. Paris.

CLARK, THOMAS, M.D., Rector's Assessor, Clyde View, Partick, Glasgow.

COOPER, GEORGE, F.R.C.S. Eng., Master of Apoth. Soc., Mem. Gen. Coun. Med. Educat. and Registr., Brentford, Middlesex.

COPLAND, JAMES, M.D., F.R.C.P. Lond., Hertford House, Brondesbury-road, Kilburn, N.W.

CORRIGAN, SIR DOMINIC, Bart., M.D. Dub., M.D. Edin., Hon. F.K.Q.C.P. Irel., M.R.C.S. Eng., Phys. in Ord. to H.M. the Queen in Irel., 4, Merrion-square-west, Dublin.

DAY, GEORGE E., M.A., M.D., F.R.C.P. Lond., F.R.S., Emerit. Prof. of Med. Univ. St. And., Furzwell-house, Torquay, Devon.

ECKHARD, C., M.D., Prof. of Physiol. Univ. Giessen.

FARR, WILLIAM, M.D., F.R.S., D.C.L., Gen. Register Office, Somerset House, London.

FERGUSSON, SIR WILLIAM, Bart., F.R.C.S. Eng., F.R.C.S. Edin., F.R.S., Surg. and Prof. of Surg. King's Coll. Hosp., Serj.-Surgeon to H.M. the Queen, 16, George-street, Hanover-square, London, W.

FROUDE, J. A., M.A., Rector of the University of St. Andrews, 7, Onslow-gardens, London, S.W.

GLAISHER, JAMES, F.R.S., Blackheath, Kent.

HALFORD, GEORGE B., M.D. St. And., M.R.C.P. Lond., M.R.C.S. Eng., L.S.A., Prof. Anat. Univ. Melbourne, Australia.

JENNER, SIR W., Bart., M.D. Lond., F.R.S., F.R.C.P. Lond., Phys. in Ord. to H.M. the Queen and to H.R.H. the Prince of Wales, Phys. Univ. Coll. Hosp., Prof. Clin. Med. Univ. Coll., 63, Brook-street, Grosvenor-square, London, W.

KÖHLER, H., M.D., Prof. of Med. Univ. Halle.

MACDONALD, WILLIAM, M.D., F.R.C.P. Edin., F.R.S.E., F.L.S., F.G.S., Prof. of Civ. and Nat. Hist. Univ. St. And.

MACLAURIN, H. NORMAND, M.A., M.D., H.M.S. "Impregnable," Devonport, Devon.

MITCHELL, W. WEIR, M.D., 1332, Wallnut-street, Philadelphia.

OWEN, R., F.R.S., F.R.C.S. Eng., Sheen Lodge, Richmond-park.

PAGET, JAMES, F.R.C.S. Eng., D.C.L. Oxon., F.R.S., Surg. Extr. to H.M. the Queen, Surg. to H.R.H. the Prince of Wales, Surg. Bartholomew's Hosp., 1, Harewood-place, Hanover-square, London, W.

PLAYFAIR, LYON, LL.D., F.R.S., C.B., M.P., 4, Queensberry-place, South Kensington, S.W.

POLLI, GIOVANNI, M.D., Milan.

READE, REV. J. B., M.A., Pres. Roy. Micros. Soc., Rector of Bishopsbourne, Kent.

ROBINSON, MR. SERJEANT B. COULSON, 43, Mecklenburgh-square, London.

SARAZIN, JULES, Médecin de Cent Gardes de l'Empéreur, 37, Rue de Bellechasse, Paris.

SCLATER-BOOTH, GEORGE, M.P., Priory, Odiham, Hants.

STIRLING, SIR WILLIAM MAXWELL, Bart., M.P., LL.D., Keir House, Dumblane, Perthshire.

STRATHEDEN & CAMPBELL, THE RIGHT HON. LORD, Hartrigge House, Roxburghshire.

THOMPSON, ALLEN, M.D. Edin., F.R.C.S. Edin., F.R.S. Lond. and Edin., Represent. of Univ. of Glasg. and St. And. in Gen. Med. Council, Glasgow College.

TULLOCH, THE VERY REV. JOHN, D.D., Principal of St. Mary's College, Vice Chancellor of the University, St. Andrews.

WATSON, SIR THOMAS, Bart., M.D., LL.D. Cantab., D.C.L. Oxon, F.R.C.P. Lond., F.K.Q.C.P. Irel., F.R.S., 16, Henrietta-street, Cavendish-square, London.

LAWS

OF THE

ST. ANDREWS MEDICAL GRADUATES' ASSOCIATION.

TITLE.

1.—The Association shall be called "The St. Andrews Medical Graduates' Association."

OBJECTS.

2.—The objects of the Association shall be the advancement of the Science and Art of Medicine, and of General Science and Literature, the maintenance of the interests of the Medical Graduates of the University, and the cultivation of social intercourse and good fellowship.

CONSTITUTION.

3.—The Association shall consist of Members, Honorary Members, and Associates.

4.—All Medical Graduates of the University of St. Andrews shall be eligible as Members, if recommended by two Members of the Association.

5.—All Members of the General Council, all Professors, and all non-medical Graduates of the University of St. Andrews, shall be eligible as Honorary Members, as well as such other learned and scientific men as may be recommended by the Council.

6.—All legally qualified Medical Practitioners shall be eligible for admission as Associates.

7.—Members, Honorary Members, and Associates, shall be admitted only at the General Sessions of the Association. The election shall be by ballot, and no one shall be declared elected unless two-thirds of the Members present vote in his favour.

8.—A Member, Honorary Member, or Associate, may withdraw from the Association by paying such subscriptions as may be due from him, and signifying his intention in writing to the President.

9.—No Member, Honorary Member, or Associate, shall be removed from the Association except in accordance with the following regulations. A

written notice of the proposed removal, signed by two Members of the Association, shall be sent to the Honorary Secretary, who shall immediately forward a copy of the charge to the Member accused, and shall at the same time summon the Council to meet within twenty-one days. He shall send a notice of the subject to be discussed to each Member of the Council at least fourteen days before the date of such meeting. If the Council shall resolve, by a majority of those present, that the Member so accused ought to be expelled, a notice shall be forthwith sent to each Member of the Association, making the next General Session special for the consideration of such removal, and if two-thirds of the Members voting shall be of opinion that the Member in question shall be expelled, the President shall direct the Honorary Secretary to remove his name from the list of Members. The votes shall be taken by ballot.

10.—The subscription constituting a Member or Associate shall be Five Shillings annually, due on the first of January in each year.

EXECUTIVE.

11.—The Officers of the Association shall be elected from the Members, and shall consist of a President, Six Vice-Presidents, a Treasurer, a Secretary, and a Council of Thirty-two; in whom the power of framing bye-laws, and of directing the affairs of the Association, shall be vested.

12.—Five Members of the Council shall form a quorum.

13.—The Officers of the Association shall be elected by ballot at each Anniversary Session of the Association.

14.—The Officers of the Association shall be eligible for re-election, except that two of the Vice-Presidents and eight of the Council shall retire every year.

15.—The business of the President shall be to preside at the Sessions of the Association, and at the Meetings of the Council; in his absence one of the Vice-Presidents, or the Treasurer, or any Member of the Council chosen by the Members present, shall take the chair.

16.—The Treasurer, or some person appointed by him, shall receive all moneys due to the Association.

17.—The money in the hands of the Treasurer, which shall not be immediately required for the uses of the Association, shall be vested in such speedily available securities as shall be approved of by the Council.

18.—The Council shall lay before the Members, at each Anniversary Session, a report of their proceedings during the past year, and also an account of the receipts and expenditure of the Association.

19.—The Council shall meet at least once in two months, unless by special resolution to the contrary.

20.—The annual accounts of the receipts and expenditure of the Association shall be audited by a Committee of three Members selected at the preceding Anniversary Session from among the Members at large.

21.—The Secretary shall have the management of the general correspondence of the Association, and of such other business as may arise in carrying out its objects.

SESSIONS.

22.—The Association shall hold an Anniversary Session, commencing on St. Andrew's day, or on such other day as the Council may determine. The place of such Session, its duration, and the business to be transacted, shall be arranged by the Council.

23.—The Members and their friends shall hold an Anniversary Dinner on the last day of each Anniversary Session, at such place and time as the Council may determine; the President for the year shall be in the chair.

24.—No alteration in the Laws of the Association shall be made, except at a General Session. Notice of the alteration to be proposed must also have been laid before the Council at least a month previously.

25.—The Council shall have power to call a General Session of the Members at any time, and shall also be required to do so within one month, upon receiving a requisition in writing to that effect from not less than twenty Members of the Association.

26.—All Special General Sessions of the Association shall be held at such place as the Council may appoint.

GENERAL.

27.—The Council shall have power to publish the proceedings of the Association, and to make such charge for them as they may deem right.

28.—The Council shall have power to order the name of any Member whose subscription is two years in arrear to be removed from the list of Members.

CONTENTS.

ILLUSTRATIONS.

Transactions of the St. Andrews Medical Graduates' Association.

1869.

ANNIVERSARY SESSION.

December 1 and 2, 1869.

The Third Anniversary Session of the Association was held at the Freemasons' Tavern, Great Queen Street, Lincoln's Inn Fields, on Wednesday and Thursday, December 1st and 2nd.

December 1.

The President took the chair.

The minutes of the previous Session were read and confirmed.

Dr. Macdonald, F.R.S., Haslar Hospital; Dr. Hayward, Hobart Place, Eaton Square, London; Dr. Simpson, Southsea; Dr. Norris, Birmingham; Dr. Davey, Ryde; Dr. Brewer, M.P., George Street, Hanover Square, London; Dr. Paine, Cardiff; Dr. Lockhart Clarke, F.R.S., Warwick Street, London; Dr. Kitching, York; Dr. Blake, Kilburn; Dr. Stutter, Upper Sydenham; Dr. Vincent, East Dereham; Dr. Blyth, Dublin; Dr. Ball Smith, Newent; Dr. Stevens, Christchurch; Dr. F. W. A. Skae, Falkirk; Dr. Irwin, Monaghan; Dr. Mackie, Cupar Fife; Dr. Buckly, Rochdale; Dr. Harcourt, Chertsey; Dr. Griffiths, Birmingham; Dr. Bennett, Hammersmith; Dr. Wilkinson, Brixton; Dr. Macintyre, Fort William; Dr. Frederick Davies, Gower Street, London; Dr. Warwick, Southend; Dr. Webb, Wirksworth; Dr. Moore, Hartlepool; Dr. Hunt, Birmingham; Dr. George, Ross, Herefordshire; and Dr. Hassall, Richmond, Surrey, were elected Members of the Association.

Mr. Row, Market Overton; Dr. Lewis, Folkestone; Mr. P. Hinckes Bird, Norfolk Square, London; Mr. Peter Marshall, Bedford Square, London; Dr. Millar, Bethnal House, London; and Mr. Kiernan, Doncaster, were elected Associates.

The Very Rev. Principal Tulloch, University of St. Andrews; Sir W. Jenner, Bart., London; Sir Dominic Corrigan, Bart., Dublin; Rev. J. B. Reade, Pres. Microscop. Soc., Rector of Bishops-

bourne; Prof. Halford, Melbourne; Dr. Robert Adams, Dublin; Dr. Andrew Anderson, Glasgow; Dr. Allen Thompson, Glasgow; Mr. James Paget, F.R.S., London; Prof. Köhler, Halle; and Dr. Brown-Séquard, Paris, were elected Honorary Members.

The Officers for 1870 were elected.

Dr. George Bird, Dr. Semple, and Dr. Wharton Hood were elected Auditors for the ensuing year.

The Treasurer's Report was read.

The Honorary Secretary read the Report of the Council.

The President proposed, and Dr. Wm. Richardson of London seconded,—

"That the Report of the Council be received and adopted."

Carried unanimously.

The "Memorandum on Criminal Lunacy" was read.

Dr. Griffith proposed, and Dr. Ross seconded,—

"That the Memorandum be adopted, and that the Council be requested to consider also the subject of Dipsomania."

Carried unanimously.

Dr. Black's paper, "On the Clinical Examination of the Urine in relation to Disease," was read.

The President, Dr. Crisp, and Dr. Day took part in the discussion.

The Session was then adjourned to the following day.

December 2.

Dr. Polli's communication on Haschisch was read and discussed.

Dr. Cholmeley read a paper on The Therapeutics of Ammonium Chloride.

The President delivered the Anniversary Address, "The Science of Cure."

Dr. Copland proposed, and Dr. Lyon Playfair, M.P., seconded a cordial vote of thanks to the President for his admirable and eloquent address. Carried unanimously.

The President returned thanks.

The Session was then closed.

The Anniversary Dinner was held in the evening. The President was in the chair. Dr. Lyon Playfair, M.P., C.B.; J. A. Froude, Esq., M.A., Rector of the University of St. Andrews; Dr. Copland; and Rev. J. B. Reade, President of the Microscopical Society, honoured the Association with their presence as Guests.

Dr. Lyall, R.N., returned thanks for "The Army, Navy, and Volunteers." Dr. Lyon Playfair returned thanks for "The Houses of Parliament and our Member." The President proposed "The University of St. Andrews and the Lord Rector," Mr. Froude returned thanks. Dr. Cholmeley proposed "The University of Edinburgh and the sister Universities," Dr. Copland returned thanks. Dr. Crisp proposed "The President, and the St. Andrews Medical Graduates' Association," the President returned thanks. Dr. Cooper Rose proposed "The Learned Professions," the Rev. J. B. Reade and Mr. Serjeant Robinson returned thanks. Dr. O'Connor proposed "The Poor-law Medical Officers' Association and its President," Dr. Rogers returned thanks. Dr. S. Hill proposed "The Officers of the Association," Dr. Seaton and Dr. Sedgwick returned thanks.

I.

BUSINESS OF THE ASSOCIATION AND COMMUNICATIONS IN CONNECTION THEREWITH.

REPORT OF THE COUNCIL.

December 1, 1869.

In meeting the Members of the St. Andrews Medical Graduates' Association at this the Third Anniversary Session, your Council have first of all to offer their congratulations on the continued prosperity of the Association.

At the last Anniversary Session the number of Members was 522, of Associates 15, and of Honorary Members, 27. Since then 9 Members have died, 17 have resigned, and 2 have been removed under Law XXVIII. for nonpayment of subscription. During the present year 35 new Members have been elected, 7 Associates, and 11 Honorary Members. The numbers of the Association at present being 529 Members, 22 Associates, and 38 Honorary Members.

The Members whose deaths it is the painful duty of your Council to report since last year, are Dr. Bate, London; Dr. Garlick, Halifax; Dr. Locking, London; Dr. Murray, Oaken; Dr. Ogden, Manchester; Dr. Rattray, Motherwell; Dr. Mortimer Rowdon, London; Dr. Withrington, Blackburn; and Dr. Yearsley, London.

Your Council request earnest attention to the statement of the Treasurer, and would urge in the interest of the Association a compliance with his request that subscriptions be regularly paid in advance.

Your Council perceive that some Members of the Association have not yet become Members of the General Council of the University; a necessary condition of the exercise of the franchise. Your Council would remind such Members, in the words of the Act of Parliament, that "all persons on whom the University has, "after examination, conferred the Degree of Doctor of Medicine," are entitled to become Members of the General Council, on making application to the Registrar of the University and transmitting to him a registration fee of twenty shillings. This is a fee for life, no further payment being required. The General Council meets twice

a year, on the last Thursdays of March and November respectively, "to take into consideration all questions affecting the well-being and "prosperity of the University, and to make representations from "time to time on such questions to the University Court." It elects the Chancellor of the University, and one of the Assessors of the University Court, as well as, in conjunction with the General Council of the University of Edinburgh, the Member in Parliament for the conjoined Universities. When a poll is demanded, these elections take place by means of voting papers. Your Council would urge upon all Members of the Association who are not yet Members of the General Council, the need of their becoming so, in order that the Faculty of Medicine may have its due weight in the government of the University.

During the year it has been necessary to appoint an Assessor of the General Council in the University Court, and for the first time, the great bulk of the Doctors of Medicine, who constitute by far the larger number of Graduates of the University, have been enabled to participate in his election; and have evidenced the interest they take in the honour and welfare of their Alma Mater by sending the President of the Association as their representative in the highest Court of the University.

At the Anniversary Session of last year you instructed your Council to take such steps as they might deem most advisable to obtain the repeal of the regulation limiting the number of non-resident Graduates in Medicine to ten annually. A memorandum was drawn up, and submitted to the General Session on the 8th of April of this year, when it was received and adopted. The memorandum was printed in the second volume of Transactions, page 253. It was presented to the University Court as a memorial from the Association, accompanied by the following letter from the Honorary Secretary to the Lord Rector of the University, the President of the Court.

"2, Gloucester Terrace, Hyde Park,
"October 12, 1869.

"SIR,—I am directed to inform you that at a General Session "of the Saint Andrews Medical Graduates' Association held in "London on December 2, 1868, it was unanimously resolved "'that the Council be instructed to take such steps as they may "'deem most advisable to obtain the repeal of the regulation "'limiting the number of non-resident Graduates in Medicine to

" 'ten annually,' and that in accordance with this resolution the " enclosed memorandum was drawn, and at a subsequent General " Session of the Association held in London on April 8, 1869, was " received and adopted.

" I am further directed to submit the memorandum to the " Members of the University Court of St. Andrews, and to pray " them to take it into their consideration with a view to the re- " moval of the grievance therein set forth.

" I am, Sir, your obedient servant,

" LEONARD W. SEDGWICK, M.D.,
" Hon. Sec. St. And. Med. Grad. Assoc.

" To the Lord Rector,
" President of the University Court, St. Andrews."

The meeting of the University Court was held at St. Andrews on October 13th last, when Dr. Richardson, as Assessor of the General Council, brought the subject before his colleagues, and, in compliance with the usual custom in such matters, gave notice that at the next meeting of the Court he would move that the regulations concerning the conferring of Medical Degrees on persons who have not kept terms at the University be modified in accordance with the views set forth in the memorandum which had been laid before them. Your Council have great confidence that the University Court will see fit to comply with a request for a modification of the regulations, which would advantage the University no less than those who, by this limitation to ten, are now precluded from offering themselves as candidates for the Degree of Doctor of Medicine.

The plan for a General Registration of Disease, based on the Poor-law Medical Officers' Returns, which was brought before the Association last year by the President, and which had been first proposed by him in 1856, has engaged the serious attention of your Council. A joint Committee, composed of representatives of the Medical Society of London, the Metropolitan Association of Officers of Health, the Poor-law Medical Officers' Association, and our own Association, has had several meetings, and has embodied its views in a "Memorandum on the advantages to be de- " rived from a Registration of Disease, and the mode in which such " a record may be obtained," which, with the accompanying proposed modification of the Poor-law Medical Officers' Returns, will appear in the forthcoming volume of Transactions. This conjoint Committee has had an interview with the Right Hon. George J.

Goschen, M.P., President of the Poor-law Board, and has obtained his approval of the general features of the scheme. Your Council trust that in this, or some such way, a general registration of disease as it occurs in the poorer classes of the community throughout the whole extent of England and Wales will be obtained, which, marking the plague spots of the nation, will afford more sure and certain information of the course, the character, and the causes of disease, and will materially help towards that perfect knowledge without which, and just in so far as it is wanting, sanitary measures are but imperfect strivings after good.

After the discussion on Dr. Tuke's paper, "On the Criminal Responsibility of the Insane," read at the last Anniversary Session, a resolution was passed requesting your Council to consider whether a memorial on the matter should be presented to the Houses of Parliament. Up to the present time the Government and Parliament have been so much occupied with urgent matters of general legislation that your Council have thought it best to postpone the subject. In the meantime a "Memorandum on Criminal Insanity," pointing out the discrepancy between the civil and criminal law in the estimate of the value of delusion as a bar to legal proceedings, and showing the unsatisfactory nature of the tribunal, an ordinary jury, which has to determine the presence of insanity, has been prepared and will be laid before you.

Your Council in conclusion would urge upon all a retrospect of the work of the past two years as proof of the need of an Association for the maintenance of the interests of the Medical Graduates of St. Andrews, and of the success which ever attends a common effort for the common good.

B. W. Richardson, M.D., F.R.S., *President.*
Leonard W. Sedgwick, M.D., *Hon. Sec.*

REPORT OF THE TREASURER.

THE Account of Receipts and Expenditure for the year 1868 has been audited, and a balance of £20 13s. 11d. against the Association is shown to exist. This deficit is entirely due to the omission on the part of many Members of payment of the subscription in the year when it becomes due. A sum of no less than £39 5s. was due to the Association on December 31st from unpaid subscriptions. The Transactions form far the largest item in the expenditure of the Association, and as this cost is incurred in the early part of the year it is most essential for the well-being of the Association that subscriptions be paid punctually in advance.

I have the pleasure to report that at present this deficit is reduced, and would be entirely paid off, as well as the current expenditure of the year, by the 31st of December, if all the subscriptions now in arrear were paid by that time.

J. H. PAUL, M.D.,
Hon. Treasurer.

December 1, 1869.

ABSTRACT OF ACCOUNTS FOR 1868.

	£	s.	d.		£	s.	d.
Subscriptions for 1868	148	7	6	Transactions (500 copies) . . .	96	1	7
Arrears	5	0	0	Stationery & Stamps	37	11	0
Payments in advance	15	2	6	Printing	19	12	4
Surplus of last year	5	10	3	Advertisements . .	2	18	0
Sale of Transactions	2	17	4	General Sessions & Anniversary Dinner	29	15	0
Balance due to Treasurer	20	13	11	Sundries	11	13	7
	£197	11	6		£197	11	6

Examined and found correct,

THOS. BALLARD, M.D.
H. COOPER ROSE, M.D. } *Auditors.*

J. H. PAUL, M.D., *Hon. Treasurer.*

LEONARD W. SEDGWICK, M.D., *Hon. Sec.*

MEMORANDUM ON THE CRIMINAL RESPONSIBILITY OF THE INSANE.

In an authoritative exposition of the law "respecting alleged crimes "committed by persons afflicted with insane delusion," the Judges in reply to the House of Lords say, "that, to establish a defence "on the ground of insanity, it must be clearly proved that at the "time of the committing of the act the party accused was labouring under such a defect of reason, from disease of the mind, as "not to know the nature and quality of the act he was doing, or, "if he did know it, that he did not know he was doing what was "wrong." They are also of opinion that notwithstanding a person labouring under "partial delusions only, and not in other respects insane," "did the act complained of with a view, under the influence of insane delusion, of redressing or avenging some supposed grievance or injury, or of producing some public benefit, "he is nevertheless punishable, according to the nature of the "crime committed, if he knew, at the time of committing such "crime, that he was acting contrary to law."

The fact of a man being insane at the time of his commission of a crime is not admitted by the law of England as a reason for the remission of the punishment awarded to such crime. In order that insanity may be pleaded with validity as a defence, it must be also proved that the accused, however mad in other respects he may be, was not conscious that the act was one he ought not to do, the act being at the same time contrary to the law of the land.

Insane persons generally, with the exception of idiots and such like, know the difference between right and wrong; know that it is right to obey a law, wrong to disobey it. It was a recognition of this fact that suggested to its originators the non-restraint system of treatment of the insane, and the general acceptance of this plan,

and the beneficial results which have ensued from its adoption, bear the strongest testimony to its truth and justice.

The law in regard to testamentary capacity differs *in toto* from that relating to insane persons who have committed crimes. In order that a will may be valid, the testator, at the time of making it, must be of a "sound and disposing mind." The meaning and value of this phrase have been declared by Lord Penzance, then Sir J. P. Wilde, in his judgment in the case "Smith and others *v.* Tebbitt and others." He says, "There is no country in the world in "which the law permits a larger exercise of volition in the disposal "of property after death than in England. But it requires, as a "condition, that this volition should be that of a mind of natural "capacity, not unduly impaired by old age, enfeebled by illness, "or tainted by morbid influence." "A person who is the subject "of monomania, however apparently sensible or prudent on all "subjects and occasions other than those which are the special "subject of his infirmity, is not in law capable of making a will."

The existence then of mental disease incapacitates a person for making a will. And if the disease evidence itself only by partial disturbance of the intellect, having no relation even to any matter or business connected with the will, still the incapacity exists. For in the same judgment Lord Penzance says, "I con- "ceive the decided cases to have established this proposition— "that, if disease be once shown to exist in the mind of the tes- "tator, it matters not that the disease be discoverable only on a "certain subject, or that on all other subjects the action of the "mind is apparently sound, and the conduct even prudent, the "testator must be pronounced incapable. Further, that the same "result follows, though the particular subjects upon which the "disease is manifested have no connection whatever with the testa- "mentary disposition before the Court."

In this matter no question of knowledge of right and wrong is introduced, the existence of even partial mental disease is sufficient to cause the law to deprive a man of one of the most cherished rights of a freeman,—the power to leave his property as he thinks best, his proposed dispositions being in other respects legal.

If it be just that the existence of a mental disease should be sufficient to render a person incapable, in the eye of the law, to leave instructions for the disposal of his property after his death, it cannot be just that a person afflicted with a similar mental disease

should be subjected to the same punishment as a sane person when he has committed a crime.

The existence of mental disease or insanity in any person is often patent to all; but there are not a few cases in which the nicest tact, the greatest discrimination, and the calmest judgment, are needed to determine its presence; and it is of the nature of things that the cases of disputed sanity in courts of law are of this character.

The mode of taking the evidence of medical men whether in support of the sanity or the insanity of accused persons is practically the same as that in which evidence on all ordinary matters is taken. Medical witnesses are retained by the prosecution and for the defence; they are examined and cross-examined for the purpose of supporting the preconceived assertions of one side or the other; and the testimony being thus rendered confused and conflicting, the determination of the truth is remitted to a jury of persons who have very seldom paid any attention to the subject of insanity, and whose education and previous habits have not rendered them specially fitted for the consideration of so delicate and so intricate a subject.

Such a mode of proceeding is well calculated to make a partizan of a witness who should be of neither side, and consequently badly calculated to discover truth; for the determination of the existence or non-existence of insanity is often most difficult. By this means not only is the medical witness often converted into an advocate, but, as one who will speak with no hesitating voice is the best witness for his own side, men of strong, pronounced, and extreme opinions are selected in preference to those of more moderate views.

Again, the jury, under this mode of procedure, are expected to give a decision on matters which it is impossible that they can fully appreciate or understand. As Lord Penzance, the Judge of the Probate Court, has said in the judgment above quoted, "While the world at large can only con-
"trast the doubtful case with the sane, the physician has at hand
"the alternative contrast with the insane. It is a consequence of
"these alternative methods of judgment that the question of in-
"sanity, though it falls to the lot of a legal tribunal, is properly a
"mixed one; partly within the range of common observation, and

" in so far fit to be considered by a jury; partly within the range " of special experience, and in so far the proper subject of medical " enquiry."

For these reasons it is contended that the law concerning persons alleged to be afflicted with insane delusion who have committed a crime, and the mode in which medical testimony as to the sanity or insanity of an accused person is taken, should be submitted to the consideration of a Royal Commission with a view to the amendment thereof.

B. W. Richardson, M.D., F.R.S., *President.*

Leonard W. Sedgwick, M.D., *Hon. Sec.*

MEMORANDUM ON THE ADVANTAGES TO BE DERIVED FROM A REGISTRATION OF DISEASE, AND ON THE MODE IN WHICH SUCH A RECORD MAY BE OBTAINED.

Adopted at a Meeting of a Committee representing The St. Andrews Medical Graduates' Association, The Medical Society of London, The Metropolitan Association of Medical Officers of Health, and The Poor-law Medical Officers' Association, held June 16, 1869.

THE Records of the Mortality of the several districts of the United Kingdom have for some time been collected, formulated, and periodically published by the General Register Office.

One great practical advantage resulting from this, besides other benefits, is that it affords a means of ascertaining the relative health of the different parts of the country; and the attention of the authorities being thus directed to those districts where the mortality is excessive, preventable causes of disease can be ascertained and removed.

But the amount of mortality is no reliable indication of the actual frequency of disease, because of the varying mortality of different epidemics of the same disease, and of the very different mortality of different diseases.

A small mortality is no indication of the relative importance of a disease; for a sickness which incapacitates for work, but does not kill, is often a greater injury to the collective producing power of a nation than a sickness of which the mortality is great.

The knowledge, then, to be derived from the death lists is defective, and insufficient for its great purpose, the prevention of disease.

A numerical record of the cases of sickness as they occur, supplemented by the further information of the age, sex, occupation, and residence of the person attacked, and the manner of termination of the disease, whether in recovery or death, can alone furnish the required knowledge.

It is manifestly impossible, however desirable it might be, to obtain reports of all the cases of sickness as they occur in the United Kingdom.

Most diseases, especially diseases depending on preventable causes, strike hardest the poorer classes of the community, and a record of the diseases attacking them would be a very sufficient gauge of the proportionate frequency and of the actual character of the diseases afflicting the entire population.

A very large number of the poor are recipients of public aid at the hands of the Poor-law Medical Officers; they are visited at their own homes, or at the workhouse in the immediate neighbourhood, so that notice of the occurrence of disease amongst them would almost invariably come from the actual place where it had been incurred.

There are about 3,200 Poor-law Medical Officers in the United Kingdom, attending annually, as nearly as can be computed, 3,000,000 of cases of disease.

Weekly or fortnightly, the 3,200 Poor-law Medical Officers furnish their respective Boards of Guardians with a return, under several heads, of all the cases of sickness at the time under their care.

These valuable returns serve now for a mere local purpose. But the information they contain would, if collected and tabulated, furnish the data necessary for a knowledge of the distribution of disease generally, the character of diseases special to localities and occupations, and the presence and spread of epidemics.

By the action and authority of the Poor-law Board a Registration of Disease, based on these returns, may be effected.

The needful arrangements for such a purpose are simple and inexpensive; the columns of the present form of District Medical Officers' Returns should be rearranged and added to, so as to consist of two parts separated by perforations; one part (*A*) containing all the information necessary for the Board of Guardians; the other part (*B*) containing the particulars needed for the Registration of Disease. Part "*B*" should be entirely filled up by the medical officer, as well as the columns in Part "*A*" headed "Days when attended, or when medicines were furnished," "Necessaries ordered to be given to the patient," "Present state or termination of the case," and "Observations;" the other columns in Part "*A*," being duplicates of those in the part relating to the Registration

of Disease, should, following the precedent of the present Workhouse Book which is partly filled by the medical officer and partly by the master, be entered by the clerk or other officer appointed for the purpose. For workhouses the same plan may be adopted with but slight modifications. Specimen forms are appended showing the alterations required.

This scheme is simple, it is easily carried out, and it meets the requirements both of the Boards of Guardians and of a system of Registration of Disease.

Part "*B*" of the sheets of returns should be sent weekly or fortnightly, according to their arrangements, by the several Boards of Guardians to the General Register Office, where they should be tabulated and classified. The Weekly Meteorological Reports, obtained from the different stations of the United Kingdom, being sent to the same office, and the geological survey of the country being completed, the Registrar General would be able, by periodical publication of the classified returns, to furnish the central health authorities and the public with accurate information concerning the dependence of disease on climatic conditions, such as moisture, cold, and soil; concerning the dependence of disease on bad hygienic conditions, such as overcrowding, defective sewerage, and dirt; concerning the special diseases of artizans, such as workers in lead, grinders, and miners; concerning local prevalence of disease, such as cancer, stone, and consumption; and concerning the earliest appearance of epidemics, such as cholera, diphtheria, and typhus. The existence or the great prevalence of these and such like diseases being known, immediate steps could be taken to ascertain their causes, and to remove them where possible; and measures could be adopted, without loss of valuable time, to prevent the spread of infectious disorders to uninfected districts.

The comparatively small expenditure required for this great national object would be abundantly repaid in the increased power which would be obtained for the prevention of disease, and the consequent improvement in the general health and welfare of the community.

B. W. Richardson, M.D., F.R.S., *Chairman.*

Leonard W. Sedgwick, M.D., *Hon. Sec.*

DISTRICT MEDICAL RELIEF BOOK.

(A) This part to be retained by the Board of Guardians.														*(B) This part to be sent to the General Register Office.*							
To be filled up by the Clerk.				To be filled up by the Medical Officer.																	
				Days when attended, or when Medicines were furnished.																	
Name.	Age.	Residence.	Nature of Disease.	Sunday.	Monday.	Tuesday.	Wednes.	Thursday.	Friday.	Saturday.	Necessaries ordered to be given to the Patient.	Present state or Termination of the case.	Observations.	Name.	Age.	Residence.	Occupation.	Nature of Disease.	Date of Commencement of Disease.	Recovery or Death.	Observations.

PARISH OF ____________ WORKHOUSE MEDICAL RELIEF BOOK.

(B) This part to be sent to the Gen. Reg. Office.								*(A) This part to be retained by the Board of Guardians.*																			
To be filled up by the Medical Officer.																			To be filled up by the Master of the Workhouse with the articles actually given.								
									Days when attended.							Extras.											
Name.	Age.	Former Residence.	Occupation.	Nature of Disease.	Date of Commencement of Disease.	Recovery or Death.	Observations.	Initials of Med. Off. in attendance.	Sunday.	Monday.	Tuesday.	Wednes.	Thursday.	Friday.	Saturday.	When Ordered.	When Discontinued.	Termination of Case.	No. of Ward.	Name of the Sick Pauper.	Age.	When admitted to Sick Ward.	When Discharged.	Nature of Disease.	Quantity of provisions consumed.	Extras provided.	Remarks.

II.

COMMUNICATIONS ON MEDICAL AND SCIENTIFIC SUBJECTS.

ON THE SCIENCE OF CURE.

The Anniversary Address.

By Benjamin W. Richardson, M.A., M.D., F.R.S., President.

Fellow Graduates and Gentlemen,

Some friendly critic speaking of these addresses which I have had the honour for two years past to deliver before you, has complained that they are not addresses confined to the purpose; that is to say, that they are not simply spoken to you as an Association, but are obviously intended for the medical world at large.

At once and willingly I admit the correctness of this writer's statement, though I am forced to disregard his criticism. It seems to me, it were a narrow view to descant in this place on subjects which concern ourselves only. A representative body in every sense of the word, presenting medical science in every one of its varied phases, we are bound to speak with a voice that shall be distinct to every member of the profession to which we belong, if he will hear; to show an earnestness which knows no exclusion, and an aspiration which is limited by anything rather than selfish desire. These are the ideas respecting our common tasks which I entertain, and if I am not grossly mistaken in respect to the thoughts of those with whom it is my pleasure and pride to be in frequent contact, they are your ideas also. Members of an University which claims an antiquity third only in this United Kingdom, and second to none in the persistent and steady task of keeping alight the lamp of knowledge, we are not, by tradition, likely to be extravagant or rash in our ambition to be catholic and progressive. Members of an University which has produced the scholar, Crichton the admirable—to whom history gives the palm for universality of genius and learning—we are not, by tradition, likely either to exert our skill in limited, and, except to ourselves, frivolous dissertation. We shall rather be inclined, as men usually are, however imperceptible the process, to follow our traditions as we do our hereditary instincts; and standing still on the past, that we may see which way we ought to

go on the new roads that lie open before us, shall proceed cautiously to explore, and as we explore, accurately to define. Interpreting the position which through your favour I again hold by the ideal of object thus set forth, I have chosen for discourse during the present short hour a subject of general interest to all classes of medical men: *The Science of Cure.*

One word, nevertheless, must pass my lips before I come to this general topic; a word relative to our position at this time as a political and learned organization. We are I think forced to feel, and the sensation is pleasurable, that in carrying on the work for which we were originally bound together we have experienced an unvarying, and, I had almost been tempted to say, brilliant success. We have obtained a voice in parliamentary representation; we have set foot as rulers in the walls of our own University; we have made ourselves felt as a power in discussions affecting what may be called medical social science; in this vast city as our centre, where learned societies everywhere abound, we have taken our place amongst the rest, quietly, unostentatiously, but so securely, and with such freedom from jealous opposition, that other and older societies have willingly joined with us in the carrying out of objects intended for the welfare and happiness of mankind. Further, we have endeavoured, and we are assured by those who are outside us that the endeavour here again has been rewarded with success, we have endeavoured to increase the usefulness of physic by studying it and cultivating it with a growing aversion to its dogmas and a growing appreciation of its connection with pure and simple natural science.

We recall these truths with a sense of satisfaction, for that our exertions, however laborious they may have been, have been throughout profitable to ourselves in a degree far more than is commensurate with our exertions. Moreover we blend with this feeling the knowledge that our efforts have been useful to many, who, though allied to us by the tie of common fellowship as Graduates of the same University, have not felt themselves bound to unite with us in the plans we have laid out and executed for the welfare of the Medical Graduates as a whole. We are proudly conversant of the fact that the slights to which the possession of the St. Andrews degree was subjected some few short years ago, are heard no more; that the whips and scorns of time are felt no longer; that, in short, the world, always generous when by truthful and honest argument it is made conscious of its error or prejudice or in-

justice, has in our case relented, and that it recognises us now, not as the betters, for that would be dishonest, but as the equals of those who by accident or other cause are the owners of what were once more favoured honours and credentials. We are proud, I repeat, in being conversant of this change of public opinion; and we are happy from the consciousness that those who have not sown, have reaped with us, and have become co-partners in the value of our harvest.

I would stop here to proceed to the text of my address, but I cannot let the opportunity slip of tendering a personal acknowledgment. It has pleased the Graduates, who now form the General Council of the University of St. Andrews, to assert their newly acquired right of sending a representative to the University Court, as Assessor. In this act they have shown only what was to be expected, their own independent will and power, together with their determination to evince that the University is not to them a forgotten existence, a fountain of honour which once tasted may be left to its own course, but a living reality in which they have a living interest. On whomsoever the task of representing the Graduates, after such evidence of vital action as was shown at the late election, had fallen, I should have felt profoundly gratified with the result. But that unsolicited the Graduates should, by a large majority, have elected me to be their representative, is a distinction as little expected as coveted, and for which I can offer in return no more than most inadequate thanks, and a promise that in all which concerns the prosperity of the University—not the University as it lies, so silent and so lonely on the margin of the Northern Sea, but the University as it exists the world over, in the scholars who compose it—I will to the end of my term of office, if I live to that, devote myself, according to my best judgment, with untiring fidelity.

SCIENCE OF CURE.

I leave the personal with much relief to come to that topic which is of general meaning—the science of curing disease. I deal boldly at once with the word and the act, Cure. Ambrose Parè, touched with a scepticism which is thought to belong to modern times only, or modestly concealing his own art, or venturing on a conceit which seemed to proclaim modesty, was accustomed to say respecting his

patients, "I treat them, God cures them." The sentiment is specious, because of the many ways in which it may be interpreted; but for my part, after thinking over it for many years as a sentence supposed to embody the whole meaning or meaninglessness of physic, I am forced to throw it aside in all interpretations of it except one, in which it becomes a flat truth, viz., that we are all, as the procedures from a common Divine Power, the mere instruments of that Power, so that the thing we effect is the real agency of the Power itself by which we are and do. To be fully explicit, I throw the sentiment aside when it conveys that what we do in the treatment of the sick is not, in effect, action towards cure, action we veritably command, but is something done for the sake of doing, the issue of cure having no absolute relation to our skill as curers. I cast, I say, this view aside as contemptible, false, wicked. We exist as a numerous, energetic, and influential body amongst the sons of men. Do we exist for nothing but to look on the miseries of mankind, and interfere and not cure? Is it to be assumed as a fact that if we were all snuffed out to-day the mass of mortality, of pain, of sorrow, would be the same this day twelve months as it is to-day, and that the army of untrained, uneducated men and women who by mere instinct would rise to fill our places as attendants upon the sick, would in the long run as effectively as we have done, fill the places we have occupied? The idea is preposterous: if we cannot say boldly as truthfully that we live to cure, it were better for us not live at all under the pretence of being curers. For myself, I can as boldly as truthfully affirm that I live to heal; that there are now a few persons at least in the world who but for me, or a some such aid as would have been rendered by some other Æsculapian brother, would now have been amongst the dead; and I am bold also to say that there are many whom I have relieved from pain and disease, if not from death; and what I venture thus to state as to myself, I state broadly as relating to every educated practitioner of medicine.

Affirming so much, let me at once qualify the general statement by admitting that our power for effecting cure is as yet limited; and let me again qualify this assertion by another, that the limitation of our power is not due to impossibility of effecting more, but to defective skill in carrying out what might be done, and what ought to be done. If we can cure ague or secondary syphilis, and we can cure both, we ought to be able to cure typhus or cancer; and if we can suppress smallpox wholesale, and we can so suppress it,

we ought to be able to suppress scarlet fever. In short, success in one direction proclaims the possibility of equal success in other directions, and leaves us the conscious masters of all the unknown in our vocation.

The question then is, Why are we so long tarrying in our way to successful progress? It would be an easy answer to plead the difficulties in the way, but the answer would be unworthy: for perhaps in some measure we may be the authors of the very difficulties we assert, and if we be not, in a calling such as ours, where every triumph is so noble a triumph, difficulties are the last reasons for complaint. No! let us drop difficulties, and looking the way before us and around us without hesitation, let us try and see what obstacles, not difficulties, demand removal; what new methods of research demand and command attention.

In this study it seems to me there are certain internal reforms of thought, and certain advanced and new modes of thought, required before we can make headway; we have to cast off weights which now too easily beset us, and to take up instruments for progressive work, with which our hands must learn to be more familiar.

OBSTACLES TO ADVANCEMENT.

The first load we have to cast off is general dogma and the use of meaningless phrases and conceits which are allowed too readily to be confounded with principles of science. We have to escape from the fangs of the learned without wisdom, in this effort; for it has happened that individual men have laid chains on us for generations by mere dogmatic and senseless speculation. Allow me to illustrate this truth by an example. In the beginning of last century there flourished at Halle a learned medical scholar by the name of Michael Albertus. Michael taught the practice of medicine in the University of Halle, with *éclat* unbounded. An industrious man, he left no less than three hundred and eighty-five essays behind him, not one possibly with a single poor fact; yet all influencing his days, and the days that came, and even the days that are. Full of speculative fancy leading to nothing, and wanting utterly in experimental foundation, our learned Michael took it into his head to divide the process of curing into three great branches, and he was good enough to devote a special essay to the elucidation of each branch. His first essay he named, "De curatione per contraria;" his second, "De

curatione per similia;" his third, "De curatione per expectationem."

The dogma enunciated in the first of these essays, because it seems to cover the largest view of curative medicine, has been the most orthodox, and in distinction of it, the term Allopathy has been applied. The dogma enunciated in the second of these essays, "De curatione per similia," seized upon by another wilder and more concentrate dogmatist than the master, I mean Hahnemann, has been converted into a pretended all-curative system under the name of Homœopathy. The third of these essays, "De curatione per expectationem," seized on by other concentrate dogmatists, has also been converted into a pretended system under the name of the Expectant Treatment; and has been the delightful resort and resource of all the timid sceptics for many generations. In fine, these three divisions of so-called curative medicine remain as actual systems to the present hour: absolute systems for men to live and practise by; yet all gross and imbecile assumptions, each a curse blighting science, and saying to medicine:—"You may be a practice, a system, a school, but a true science you shall not be." Now I think the time has come when we should manfully declare ourselves freed not from one, but from all these dogmas. If a patient come to me with a limb broken and bent, I straighten that limb and place it firmly in its natural, as distinguished from its unnatural, position; but it were an insult to tell me that because this is my practice I am an allopathist. If a patient come to me and say, "I have eaten something which makes me faint and inclined to vomit," I will give that patient an emetic, and relieve him of his anxiety; but it were an insult to tell me that because I do this I am an homœopathist. If a patient come to me and say, "I have a sadness of spirit which I cannot overcome," and I see that he has no physical evil, I may decline to prescribe any specific remedy, but may assure him of his safety, and tell him in other words, after Horace:—

> "What if thy heaven be overcast,
> "The dark appearance will not last,
> "Expect a brighter sky;
> "The god that strings the silver bow,
> "Awakes sometimes the muses too,
> "And lays his arrows by."

And if this man, waiting for the brighter sky, as I advise and assure him, does in time see it and recover, I have truly treated

him; but it were an insult to tell me that because this is my practice I am a follower of those who carry out the expectant method.

Michael Albertus, well-meaning and innocent scholar, is a good mark of scholars for us in these days to avoid. I set him up to knock him down as a public danger, and I would like to bury him and all like him, lest any should stumble over him and them when down. My object has been to point the moral which his innocent but mischievous diversion teaches. The time lost, the intellect lost, the money lost, and in and by all these losses, the lives lost by constructive opposition to true progress, are incalculable, and the moral to be learnt from the history is, that dogmas in medicine ought from henceforth to be allowed no moment of life; but that every step of advancement in curing disease must be a single step, proved by its own excellence, based on its own merit. It must be like a chemical experiment, the details of which are known and are susceptible of being tested and demonstrated by every competent practitioner. *First obstacle to be removed:—Dogmatic generalization.*

Another obstacle in our way, as it seems to me, is reliance on what is commonly called individual experience as distinct from general experience. I have heard from my youth upwards about the experienced practitioner, but for the life of me I never could, in a scientific sense, discover him. I never met with any one physician or surgeon who by virtue of special or individual experience actually cured more sick people out of a gross number treated, than any other physician or surgeon, while I have persistently observed that there are certain diseases which we all cure, by common methods, with equal facility. This observation forces on me the conviction that whatever is not common experience is not experience at all in the proper sense of the word; that is to say, not experience which is of any value, but mere experience of unknown coincidence running by the side of supposed curative application. When two men meet, and one, on his individual experience, records the great success which has attended his administration of some particular remedy, and the other affirms from as large an experience that he has had no success, what is to be believed:—something, nothing? Yes, something; to wit that the observation of the action of the said remedy is uncertain, and that the probabilities are all on the negative side. No two men disagree on the *obvious* effects of remedies. Every man who has seen chloroform administered agrees with the rest of his brethren that the chloroform produces a general and decisive effect, and this rule hold

good in respect to all medicines which are reliably based on general experience. In general experience we have common truth, in individual experience which cannot be generalized, we have special and undisguisable error, superficial observation and that pride of self-sufficiency which my Lord of Verulam has justly stamped as the idol of the den; that is the idol which each individual conceals in his own den or cavern which intercepts or corrupts the light of nature. Straight across the path of unproven individual experience, that experience which is personal and will not mix with all experience as fast as it is turned out, let us dig a trench that it may bolt off sideways, and an embankment that it may not flow on us. The work ought to be carried out promptly, promptly. We go to our societies, and what do we hear, until we are nauseated with the sound? Contention, contradiction; words, words, words! From what source? Experience. "I am very glad, Mr. President," says one, "that the author of the paper we have just heard has given us the results of his long experience; it is, sir, experience that we want in these societies. But, sir, I could not allow a paper so important as this to pass, without saying that from a course of observation, perhaps as extensive as my friend's, my experience of his treatment is contrary, nay I should say diametrically opposed, to the views he has so ably put before us." And when this debater has finished, a weaker knee'd brother will rise and in complaisant humour will affirm "that he has learnt something from both sides and in future will try both methods, assured that two men of such profound experience must both, in some points, be right." I ask you, brethren, is it not time that this system of airing individual experiences should be reformed altogether. Is there a scintillation of light or truth or sense in it? Are we not making conspicuous fools of ourselves when in the face of other and more exact scholars we talk in this contradictory and feeble strain? Candidly I think so, and while I know it is asking much of human nature to beg it to give up private judgments and conceits, so that nothing may be forced that cannot be made sensible to all, and nothing maintained that cannot be so defined as to use, as to be in accord with general observation, the asking is but the foreshadowing of a change which must inevitably come, and which cannot for the safety of medicine come too soon. *Second obstacle to be removed:—Individual experience that cannot be made general experience patent to all who will learn it and convincing to all.*

A third obstacle to be removed is the fear of public disfavour. In the armour of medicine there is no point so vulnerable as this fear.

In our attitudes to please the ignorant we sink daily too deeply in our own estimation, and by consequence in the admiration and confidence of the ignorant. On this timidity of ours the charlatan feasts. A grand remedy which the common experience of the best of our brethren has for centuries held as grand—a real remedy, from the absence of use of which men die daily—comes into popular disfavour, and lo, the profession deserts it as if it were poison or murder. Some new remedy springs up; it catches, by stray or accidental means, the public favour, and the public demand for it is actually listened to as if the professedly unlearned could and ought to think for the professedly learned. The natural result of this timidity is not satisfaction to the ignorant, but doubt respecting us all, and the introduction into our own body of scepticism on everything, cynicism, disbelief. Shall it be possible much longer for an historian of the present hour, truthfully and without fear of doing wrong, to proclaim to the historian of the future the terrible fact, that in this day, owing to the prevailing uncertainty as to our art, it would be quite possible for a professed healer to advance by stroke of fortune to the first rank of notoriety as a physician—I do not say fame, but notoriety—the said so-called healer having no belief in any remedial measure, but looking serenely on the work of each day of his life as so much ceremony which has simply to be got through with so much grace and deportment. I trust it will not be possible for this to be said long truthfully as a part of history. Every hour it remains a fact it demoralizes that hour; but if it is to be removed, the element of fear must be excluded from our own ranks. We must know in what we do believe, and be consistently firm in enforcing our belief, letting no temporary advantage to ourselves pay us for unmeaning, and, in our case, faithless complaisance.

Never was there a period in the course of physic when firmness of purpose was so seriously required. In the old days the physician existed as a solemn mystery; by his excess of learning he stood a head above those amongst whom he moved; there was a wonder and a charm surrounding him. The names of his drugs were, to the illiterate masses, symbols; he was a power, and his word was law. Now the charm is melting away, the symbols are well nigh lost in the blaze of general enlightenment, and we, as a body remaining in doubtful hesitation, must be approached in knowledge by the whole reading and thinking world. Our duty then, not less than our interest, is to retain our power. Shall we retain it by doubting

our own capacity to retain? I submit we shall not, and that we can only hold our own by the introduction into our learning of such positive science as shall enable us to be firm in all our work; firm in foreseeing results; firm in prescribing remedial measures, and simple in all things we carry out, our simplicity resting on our sincerity, and our sincerity on the exactitude and fulness of our attainments. *Third obstacle to be removed:—Fear of popular criticism and popular demand; in other words,—Fear of fashion and its caprices.*

I have dealt with three of the most potent obstacles to our permanent success as a profession, and now I turn to the consideration of some of those means of progress which will tend most surely to affirm us before the world, and to consolidate us as a living and useful power.

METHODS OF ADVANCEMENT.

I notice first on this head the necessity that exists for condensation of truths which we already partly understand. We have floated into a sea of profuse knowledge, and have thought that man the most eminent who has been the most adventurous in setting sail to know more. It would be folly to find fault with the pursuit of new knowledge; but there are times when to know much and not to do much is dangerous speed. A time must always come in every mind and in every class of minds when knowledge should be brought into definite shape and form by reason. One of our poets puts what I mean on this point into perfect language when he says—

> "Knowledge and wisdom far from being one
> "Have oft times no connection: knowledge dwells
> "In heads replete with thoughts of other men;
> "Wisdom in hearts retentive of their own.
> "Knowledge, a rude unprofitable mass,
> "The mere material from which wisdom builds,
> "Till planed, and squared, and fitted to its shape,
> "Doth but encumber whom it seems t' enrich.
> "Knowledge is proud that she has learned so much,
> "Wisdom is humble that she knows no more."

Who does not feel individually the whole force of this argument, and who is the thinking and thoughtful man who does not recognise its special force in relation to the progress of medicine into science? I look round on the instruments of cure now at our command, and in not one direction do I see any approach to complete-

ness of design. Great things are begun, used for a while, are unseemingly paraded, unbecomingly, nay, feebly admired; then lost for a time, supplanted by some other new object; anon revived, and again cast aside. Richard Lower gives us the practice of transfusion of blood; it is a very rage for a season; it truly opens up lines of treatment, the value of which, were they followed out, were incalculable in beneficent results; but the practice is anathematised, and down it drops, for a century or more. It partially revives, and once again promises results unexpectedly grand. Again it falls, and to this day remains in no better, if so good, a position, as that in which its master left it. Vesalius and Hooke put us on the way to the use of artificial respiration; another wonder in its day, and for a time it too is forgotten. It comes up again in our time, is asserted as doing what it never can do, is thereupon distrusted, except in some particular cases of emergency, and remains, potent as it is, as imperfect as a practice as when it was an imperfection connected with a first step of knowledge. Priestly and Beddoes opened up to us the practice of administering factitious atmospheres. The first results obtained were undeniably great, and once more all was wonder at the achievement. Time passes, and the practice falling out of favour lapses into uncertainty, and remains as uncertain as ever; so uncertain that at this hour the simple question, the most primitive question we could be called on to answer, the question, I mean, whether the administration of oxygen in different proportion to that in which it exists in the atmospheric air is in any case really serviceable, has received no approach to a solution in which any number of physicians concur. Galvani and Volta and Aldini put into our hands galvanism as a remediable measure, and surely no remedy at any time received so much attention; it is marked as an event even in the general history of the world. A hundred years have well nigh fled away, and what are we decided upon in respect to the value of galvanism in disease? The physicists have learnt the galvanic phenomena with exactness, have applied their knowledge with a precision which leaves no doubt on any mind, and have made themselves masters of a science with which no impostor dare intermeddle. Stand we in the same position? Alas not. We continue still to use galvanism as a mode of restoring the dead to life. The one act proves our weakness. Suppose we should see an uninstructed man trying to set in action a galvanic pile, in which no oxidation was going on, by galvanising it from another pile in which oxidation was going on. What should we

think of the man? But this is what we, uninstructed men, actually do, and negative as the result is and must be, we think it a fine procedure.

I could multiply these illustrations to any extent; but enough has been submitted to prove, I trust, the proposition from which I started, that we require an interval of rest from search for new knowledge to enable us to consolidate the knowledge we actually possess.

I notice secondly that in approaching towards science of cure it is an essential matter to know what are the natural boundaries of cure. When are we practically to say,—"Here and now our art, our skill, ends"? To this question, in my opinion, the answer is that our skill ends only when in the living organism the natural cycle of life is completed. To my mind, all diseases which occur between the first and the second childhood are simple accidents; accidents as simple and as pure as collision or other physical misadventure; accidents to be avoided or prevented to a major extent, or if incurred, to be cured, should the curer have sufficient time to exert his curative skill. In this boundary, though it may seem limited to minds enthusiastic beyond reason, the practitioner of medicine finds ample scope for the noblest development of his power. To some ultimate fact he must bend, as must every student of natural science. A Newton may march up to the law of gravitation, and show, on definite principles, that the earth does truly attract all things to itself; but at this point even a Newton must needs stop, feeling that with the discovery of the law the power of the mind given to man finds its natural termination, and that to ask to know more is to assume a desire to take the place of the Supreme Will that designs the law. And so the healer, carrying up his research to the limit of the human intellect, may assert laws, but there must stop. Forcing his conclusions beyond this point, he is led into the impossible difficulty of inventing a new nature, of devising a scheme out of his range altogether, by which the evolution of life out of death shall be superseded by the introduction of perpetual life in the same form of living organism. Absurd problem! Within the natural boundary then, the healer is safe, and all the extension and grasp of his intellect is occupied with a series of questions, than which none can be nobler, none worthier, the highest intellectual capacity.

I might dwell at this stage on the question of the prevention of the physical accidents with which life is surrounded from its first

to its last and natural stage; but I am dealing with cure, not with prevention, and I therefore have to consider the scope and dimensions of cure. In other words, when the physical accident of disease has presented itself to us in any form, how shall we, within the natural limits, endeavour to save from unnatural death?

In studying the question thus proposed, the primary object is to ascertain how far any skill which we may possess is actually demanded as skill to be enforced, as rule of doctrine and of practice. The case is before us: is it a case where the sufferer will recover without any artificial aid; or is it a case where certain well-known and proved artificial assistance will assist recovery; or is it a case where there can be no recovery in the absence of artificial assistance; or is it a case altogether incurable? Unfortunately up to the present time the natural division of diseases into these groups has received no serious consideration, and so we are apt to mix up skill with no skill, the active with the inert. To those who merely pretend to cure, this unmeaning and confused admixture, in which all is maze and noise, is shelter and satisfaction. In the confusion who shall discover the pretender from the earnest labourer. In the maze the pretender can move from morning to eventide, from year to year, from age to age, and his experience shall be,—that of a certain number of sick treated, a certain number shall die, a certain number shall recover, a certain number shall doubt him, and a certain number shall lift him up as the greatest of curers, in whom they have what they call faith; faith, that is, in the man, not in his knowledge as a something that should be known. In this mazy crowd, in sorry truth, every shade of pretence finds its Alsatia. The man who dispenses infinitesimals which his arithmetic is far too weak to encounter; the man who disbelieves out and out, and bows and laughs inwardly, and looks on: all here are one.

But to earnest men this maze can be no shelter, no hiding place. And so I say to them, it is time they were out of it; time they knew the boundaries, the limitations of cure. I will dwell on this topic a moment longer, in an endeavour to open the way to new thought. We shall then, I think, relieve ourselves of much embarrassment if we can at any time come to some common standard of thought on the question whether there be any such distinct process as may be fairly demonstrated natural cure of disease. The vis medicatrix naturæ, what is that? Is it a word or a fact? We dwell upon it as if it were a fact; we dwell upon it as if it were a principle on which we can often rely altogether, and on

which we can always rely to some considerable extent. Is this correct belief?

In my way of thinking the belief has, in the abstract, no basis whatever: by which I mean that nature goes her own way without putting out any hand to us for our special and particular aid. If nature were a curer as is supposed, then all diseases were spontaneously curable, and all other curers than herself were impostors. But nature pursues her way with men as regardless of their infirmities as of their powers, her general course being towards some grand and unknown end in which the individual sinks into his true insignificance by the side of the vastness of her structure, work, design. The physical living being is born, and by the force of birth is launched into space; but from the moment it is on the earth it is under the physical influence of the earth. As when I take a stone and cast it into the air, it moves for a time against gravity, then finds a point in which there is almost balance between the initial velocity and the attraction, and anon begins in gentle curve to fall, until it has fallen and lies, *dead;* so man, passing through his curve, endowed with initial velocity or motion of life, is making really and always towards the earth. He is weak, the earth is dragging him; he is faint, the earth has drawn him nearer; he dies, the earth takes him to herself. I speak of course now only of the physical man.

So nature, projecting the man, leaves him to meet the inevitable attraction of the earth. She gives him initial velocity, she endows him with reason to avoid many dangers, and with this attribute of reason she clothes and protects him through himself. For her part she pursues her way; he may guard himself from her fury as best he can, enjoy the profusion and happiness she offers as best he may; but she must proceed to the service of the general good. The living man left thus to his course, but with reason to guide him, is neither protected from disease, nor cured of it when assailed by any special natural power or force. On the contrary, the measure of his resistance to the accidental risks to which he is exposed is so small that it may succumb at a moment; nay, when the accident is so slight that the immediate consequence is avoided, the chance of restoration from the shock is but naturally commensurate with the resistance which the body can offer to the accident; no new power is evoked, no new velocity is put forth; the most that is restored is equilibrium, or return to the condition which the organism maintained previous to the accident. The term vis medicatrix naturæ is,

in fine, an entire misnomer, except it be limited in application to the simple capacity possessed by the organism at given ages, or periods of life, to resist gravitation. I doubt not that much of the confusion of thought which has ever surrounded this theory of a force leading to natural cure, has sprung from the observation of the resistance of youth to shocks from which the advanced in life are unable to survive. It has long been recognized, for example, that the result of severe surgical operations rests so distinctly on age, that a given mortality from a particular operation, say lithotomy, may be predicated according to age, when a sufficient number of operations have been performed to afford the groundwork of a calculation. Thus from a general deduction the mind has been led to individual definitions, and what is only true in respect to the value of resistance to attraction at periods when resistance is most active, has been made to appear true in regard to detailed changes occurring from disease within the body; until at length the most fearful structural changes have been posted up as structural cures.

I remember, in illustration of this false method of reasoning, a lecture I once heard from one of the enthusiastic believers in the vis medicatrix. The professor was desirous to demonstrate to his class the curative effects of nature in the disease known as pericarditis. He commenced his learned proof of natural cure by taking the heart of the cured man out of a pickle jar, and by describing from the disorganized specimen how beautifully the heart, by exudation of lymph, had become everywhere adherent to the pericardial surface. By this adhesion it was argued the pericardium had been prevented from filling with water—a far-fetched hypothesis in itself by the way—and so life had been saved. At what cost life had been saved, at what cost of future suffering, with what certainty of early death from mechanical impediment of the circulation, no word was told. The impression intended to be left on the mind of the student was, that in the disease in question nature supersedes art to such perfection that she had better in all such cases be left alone. To me this hypothesis of natural cure is beyond estimation mischievous. If I were to bring the abraded surfaces of the chest and arm together after an injury, and the two surfaces were to become adherent, I should be guilty of malapraxis; and when nature binds two surfaces that should be moveable into one inflexible surface, or does other equal damage, though she may not be imputed guilty of malapraxis, since she is carrying out her own

determinate course, she is most certainly not effecting cure, nor silencing the art which should prevent such disaster, by any better attempt to supersede art.

To trust to what is called nature, to the omission or neglect of scientific methods for cure, is to forsake the path of duty and leave to chance that which strictly falls under the exercise of reason. The trust is fatalism in physic ; fatalism extended beyond our own interests to the life interest of those who submit themselves to our care. Are there however not some maladies, which, left purely and simply to the natural resistance, may recover without the intervention of art? In a very few slight diseases, possibly. But when the practised eye looks over the lists of disease, and the mind disposes itself to calm reflection, the list becomes insignificantly small, and the fact proclaims itself that even in the narrow list itself art is useful to cure: while, turning from the narrow slip to the long catalogue of serious disease, natural cure is the last remedy discernible. What natural process of cure is to be seen, acting as a general principle to be expected or to be relied upon, in such maladies as tubercular phthisis, cancer, syphilitic ulceration, hydrocephalus, ague, tetanus, cholera, hydrophobia? Is that a cure which leaves the sufferer from acute rheumatism with a disabled heart, or the patient under scarlet fever with structural change of kidney? Does nature or art cure ovarian dropsy or cataract? To the issue straightway. What does nature cure? I for one confess not to know. I see the stone taking initial velocity from my hand, and, uninterrupted in its course, making its way in graceful bend complete: I see it rise quickly, reach its prime, fall, rest. I see it interfered with in its way, roughly, so that it shall fall in mid-course, or slightly, so that it shall vary in direction and fall short: but, once impeded, I see no natural agency tending to make it pursue its original natural direction, or giving to it new power to resist the attraction of the great magnet. This, moreover, is what I see in the course of the physical body during its transit from birth to death, and the inference I draw from the observation is, that in following out our business of treating disease we are bound to let no idle pleasantry entice us from the effort of bringing up reason to originate and support art for the cure of every malady; to let no shrinking from labour, or other cowardly device, win us from the conscientiousness that whenever we leave disease to what we glibly call nature for cure, we confess ourselves to be what we are, incapable men, invoking an incomprehensible and indefinite aid. The

physicians once submitted what, to them, was incurable scrofula, to the royal touch.

Our minds clear on the great point that we must of a verity rely on our industry for the cure of disease, we have to bring into more perfect order for work our knowledge of the body itself. A mistaken idea prevails, almost universally, to the effect that knowledge of natural function should be secondary to what is called knowledge of practice. The royal road to success in combating disease lies, it is surmised, in knowledge of symptoms and remedies, and use of instruments for cure. Perfect knowledge of function, it is assumed, is very good for the student to learn, necessary for the teacher to sustain, interesting for the busy practitioner to possess, but cumbersome and laborious, and of small service for him to retain. Oh! sad delusion. As no study is more elevating and expanding than the study of the parts of the living organism and its functions, so to the obedient and yet free mind none is so easy; none so easy because of this beauty of it, that what is learned as new serves only to fix more persistently on the memory what has already been learned; none so easy because the simplicity of the study increases in proportion as the scope of it extends and the unities of action are discovered; none so easy because a knowledge of the whole elucidates parts and reduces the complex, I mean the apparently complex, into simple harmonies.

But the easiness and beauty of the study are not my motives for enforcing its cultivation. I would enforce the study for its practical utility if it had no other value. To be able at one flash of memory to take in the whole organic mechanism as though it were laid open before the eye, even as the works of the watch are open to the watchmaker; to see the central heart beating in the order of its work; the lungs expanding; the gases in the lungs diffusing, the blood oxidating; to see the stomach dissolving the food, the fluid food coursing into the circulation; to see the blood changing in its circuit, yielding up its colloids to the tissues and retaining its crystalloids; to see the busy lymphatics draining off the superfluous plasma, and the glands separating and discharging their respective fluids; to see the nervous screens of the senses picking up impressions and the brain receiving them; to see from its centres the animal force distributing from point to point; to see the sympathetic regulating function; and lastly, with this one grand view of structures and functions clear before the sight, to be able to detect how far perversion, observable in one function or part, influences

other functions and parts, and excites those phenomena which constitute what are called the symptoms of disease;—to see these things is to be a physician indeed, such an one as every physician should be. I set up in this review no ideal to be clutched at, but a reality to be grasped and held; a reality which, fully possessed, implies and carries with it unity of thought, unity of action, progress steady as the course of the sun, equality of knowledge, science, prescience, power;—the first and all-requisite steps towards curing disease in part or in whole.

Together with this knowledge, comprehensive yet simple, of the organic life, we require in these days to apply ourselves more determinately to the study of the action of remedies. In this work we have now opened to us several new modes of research. The relation of the chemical constitution of remedies to their physiological action, is one of the new studies we are thus invited to master, an invite the more gratifying because the study to be followed, during the brief period in which attention has been drawn to it, has teemed with cheering and certain promises. We have learned thus far in relation to chemical constitution, that substitution of one element for another, in complex chemical organic substances, may be sufficient to change the whole physiological action of these substances. We have learned that the increase of atomic weight of chemical substances modifies action, so that two bodies of the same family group, bodies belonging to the family of the alcohols for example, will induce in living animals distinct sets of symptoms, each so characteristic as not to be mistaken. We have learned that certain substances, after they have entered the body, undergo chemical decompositions which can be accurately explained as results of chemical changes occurring within the living crucible; results as definite as if they were made to take place in a glass retort. What is more, from these preliminary enquiries we are beginning to see our way so clearly as to forecast results; to be competent to predict from the known composition and the known physical qualities of a chemical substance, what will be its action upon the living animal, after its administration. Once more, we are travelling towards light in our attempts to discover the special action of particular remedies upon particular parts of the organism. Of one known substance we can say, its primary action is on the cerebral lobes; of another, its primary action is on the sympathetic centres; of a third, its primary action is on the extremities of motor nerves.

In each of these steps there is progress, progress which must be sustained by the mass of the profession falling in with it, and marching with steady and musical foot wherever it shall safely lead; progress which will speedily necessitate a complete revision of the Codex and Pharmacopœia, so that books full hitherto of dry formulas, of mixtures and pills, and powders and lotions, and receipts sundry, shall become true books of science; progress, laborious, perchance, and for a time perplexing, but which will more than repay both for the revolution and the labour.

And yet another step has to be taken. If we be called upon to study the influence of chemical constitution on the physiological action of our remedies, we have also to study with equal care and industry the influence of physical constitution on chemical action. Take one fact in illustration of what is further required in this method of advancement. A dose of opium which would suffice to kill two or three adult men may be given at once to a pigeon, and will induce no symptom of injury; but a few drachms of many simple crystalloidal substances, which would have no injurious effect whatever on the man, will kill the bird. Here is the result of difference of organization. The bird can so dispose of the opium that the drug is harmless, the man cannot; the man by virtue of quick fluid secretion can dispose readily of the salines, the bird cannot. The illustrations, I grant you, are extreme, but they bear directly on physiological practice: bear as showing how in the same class of animal, how even in the same animal, in man, differences in activity of function, differences dependent on age of subject, or construction, or disease of organs, may modify the action and the service of medicinal remedies.

I have not ventured in this place to present to your notice *details* of progress in the science of cure; that is a labour of my life elsewhere. I have chosen rather to depict the great steps of progress. Neither have I ventured to predict too much in the way of results; results may remain for our children. The fact for to day and for ourselves is labour. Our followers may be able to say, as they view the sick man struggling with what is now fatal disease, "let us put the man in such conditions for continuance of life that now he shall not die:"—but we must be content to lead towards that triumphant skill.

The position of mediciners at this moment is of men ascending a mountain to behold a new world. From the old world the ascent

is steep, and on it the professing explorers are variously grouped. Highest of all, toiling away reckless of all danger, heedless of clamour, progressing a step to-day and dropping a step to-morrow, but never failing, and never withdrawing their eyes from the goal to be reached, is a number, small but healthy, of pioneers, the scientific men of physic, who look upon themselves as almost too far removed from the world to trade with it; who see between themselves and the world many unscrupulous opponents, and who can never leave their work, even to gain their livelihood, without regret. These pioneers, struggling one day to the summit of the mountain, will discover the truth in its fulness, will make one and all, pupil and sufferer, come to them for assistance, and, in deed as in word, will command the position they have striven for. Behind the pioneers, magnificent in collegiate banners, and proudest often in their fondest weaknesses, are the masses of "legitimate medicine." They follow the pioneers, but grumble at them as they follow; call out at each step that it is rough, or irregular, or steep, or shallow, or unsafe; but do nevertheless proceed, hindered by nothing so much as their own doubt in limb, and load of individual experience. Beneath them, mounting no new step at all, wishing, indeed, to make no advance, but jabbering some obscure dogma, or pointing with ridicule to the proceedings enacting above them, stand the schismatics of physic, in garbs as various as all the national costumes of the earth, and with tongues and customs as incongruous. Placed nearest of all to the world, the world hears more of these than of any others, for they will be heard. To them, nolens volens, the sick man shall listen; of them, if it be but to rid himself of their importunities, he shall buy. They have a rule for every accident, a remedy for every malady, a cant dogmatical answer for every question. They are a lawless mob, noisy, cowardly, who, when the pioneers shall descend from the mountain, their victory achieved, will fly into the world and be lost for ever. As it is, though they stand as troublesome tricksters between the world and the scientific workers, they impede not the work.

"I treat, God cures." Thus bold Ambrose Parè, who, said his enemies when he replaced the seething iron by the ligature, "put life upon a thread." 'Twere a sin even for our friends the pioneers to forget so grand an exclamation. I hope they will retain it in their hearts reverently. Not as the abject confession of their uselessness in this world, but as the inner consciousness that they are

the instruments of a Supreme Intelligence, which, drawing nearer and yet nearer to them as they grow

> "Day by day familiar
> "With his conceptions, act upon his plans,
> "And form to his the relish of their souls,"

will, in proportion as they are prepared to receive it, fill them for their work with that eternal and celestial light, by which, in the fulness of time, all truths of nature shall be revealed to the faithful children of nature.

THE CLINICAL EXAMINATION OF THE URINE IN RELATION TO DISEASE.

By C. Black, M.D., M.D. Lond., M.R.C.P., F.R.C.S., &c.

The question of the changes which the urine undergoes in the many and varied diseases which afflict the human body, is one of great importance in its practical application to the healing art. It must, however, be confessed that, notwithstanding the progress which medicine has continued to make from the time of Hippocrates, Galen, and the Arabian physicians, even to the present period, there is, perhaps, no subject in medicine of equal importance, which has, in a practical point of view, made fewer strides towards that perfect knowledge at which it is one of the great objects of physicians to aim, than that of the clinical investigation of the changes which are produced in the urine by disease. It is true, that with the advancement of animal chemistry, especially within the last thirty years, the chemico-physiology of the urine has wonderfully increased our knowledge of the functions which are by nature assigned to the different portions of the kidney—of the nature of the urinary secretion in its relation to the metamorphosis of the tissues of the body—of the many complex constituents which are embraced by the solids of that secretion—and of the influence which food, exercise, and rest, exert upon the absolute and relative proportions of those solids, as well as upon the quantity of fluid by which they are held in solution.

In all these particulars we have reason to be satisfied with the progress we have made and the results at which we have arrived. To the attainment of this great increase of knowledge, the labours of both continental and British investigators have probably equally contributed. Whilst I write, a host of honoured names presents itself to my memory. Some of the bearers of these names have already passed away, and have left in their works imperishable records of their fame. Others yet remain, to add, let us hope, still

further to their contributions to our knowledge, and thus, whilst shedding additional lustre upon their reputation, to advance the great object of true medical art—the cure of disease and the physical happiness of mankind.

Of the names of those who have by their labours contributed to this knowledge and to this end, I almost fear to make mention, lest I should inadvertently omit the name of some one who has, at my hands, equal claims to recognition with those whom I should feel it no less a pleasure than a duty to particularise. Still, where no unworthy motive has influence, and where no slight is intended, no real imputation can lie. In this feeling and with this conviction I venture, then, to pay the homage which medicine owes to its benefactors of whatever country or clime. There is in the medical profession a special bond, as there is in the human race a common brotherhood, which binds us to one another in thought—in feeling—in the noble aspirations of the heart to minister to the good of mankind—and in the realization of those aspirations by individual successes wheresoever and by whomsoever achieved. I speak of the labours of continental investigators in urinary chemico-physiology, and medicine, in its British representatives, at once acknowledges its obligations and its gratitude to Berzelius, Boussingault, Scherer, Simon, Heller, Pettenkofer, Becquerel, Mulder, Wohler, Liebig, Lehmann, Heintz, Schweig, Schmidt, Laskowski, Lecanu, Funke, Neubauer, Vogel, Eckhard, Thudichum,* and others.

I turn to the pages which record the results of the labours of our own countrymen in this department of medicine, and there I find the names of Prout, Henry, Wilson Philip, Routh, Christison, Ure, Bird, Rees, Garrod, Bence Jones, Ronalds, Percy, Beale, Hassall, Pavy, W. Roberts of Manchester, and many others, who command the same acknowledgment of gratitude and, although it may not be an equal claim, yet still a claim, to distinction on the roll of fame. Much, it must be confessed, has been done by these enquirers; yet much remains to be done, even in the particular direction in which they themselves have so successfully laboured, before our knowledge of the urine, in relation both to health and to disease, can be considered at all complete. The investigation of the urine in disease has not kept pace with the chemico-physiology of that secretion, although, by the joint aids of chemistry and the micro-

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* Dr. Thudichum, although practising in London, I have, in consequence of his nationality, classed with continental investigators.

scope, our knowledge of urinary pathology has, of late years, considerably advanced. But our greatest lack of information is in the observance and appreciation of those changes which disease produces in the quantity, density, and colour of the urine, and of the nature and constitution of the deposits which occur in it, as well as of the adventitious products which are held in solution or suspension by it in some or all of the phases of disease. In this particular direction there is great need for future enquiry, which, if properly carried out, would lead to very important practical results. In entering upon this particular subject, which may not inaptly be termed the semeiology of the urine, a knowledge of healthy urine, as to its daily quantity, density, colour, chemical constitution, and as to the variations which these may undergo within the range of health, is absolutely necessary, in order that those deflections from health which occur more or less in disease, may be recognised, appreciated, and made the ground for legitimate deduction and treatment.

The kidneys are one of the great highways along which the exhausted tissues are conveyed from the body. They are no less the channel by which substances incapable of entering into the formation of the organism, are removed either unaltered in the condition in which they were presented to the system, or after having undergone a certain change or metamorphosis in their molecular arrangement and chemical constitution. The function of the kidneys is therefore highly conservative of health and of life. Let this function be so deranged that the elimination of urea bears no proportionate ratio to the destruction of tissue which is taking place in the body, and serious results at once occur. These may issue in violent sickness and vomiting, in severe frontal headache, in convulsions, in coma, and in death, according to the interruption which exists to the eliminating power of the kidneys and to the consequent retention in the blood of the product of the conversion of even healthy tissue into urea, which thus becomes a deadly poison to the body, of which its previously arranged elements, in the form of muscle, formed a component part. Every practical physician is well acquainted with the rapidity with which these results take place in acute nephritis, and in the latter stages of granular degeneration of the kidneys. Here, in the one instance, the secretory portion of the kidney is suddenly invaded by inflammatory exudation; in the other instance, exudation more slowly, yet progressively, occurs; in both, the proper

function of the organ is at last almost, and sometimes entirely, arrested, and death from the retention in the blood of the organic constituents of the urine occurs. If, on the one hand, we look at the chemical constitution of the urine—and if, on the other hand, we regard the chemistry of the tissues of the body—we can readily understand that, in the breaking up and dissolution of the latter in their withdrawal from the body, their ultimate elements are so re-arranged and re-combined as to appear in the derivative compounds and salts which are found in the urine.

The conclusion, then, to which this doctrine leads, regards the urine as the representative of all the dead and dissolved tissues of the body. As the blood is the great vital stream which, in its onward course through all the ultimate ramifications of the body, supplies the pabulum from which every tissue is nourished, so the urine is the great menstruum by which those tissues are, when the vital principle has once quitted their living atoms, conveyed from the body. The one fluid, then, predicates a formative object—the other, a conservative end. Both are necessarily complex in their chemical constitution; both have certain constituents in common; and, where they differ, they differ in those principles which, in the one fluid, have a prospective tendency to organisation; in the other, to the retrospect of transformation, death, and decay.

According to the present state of our knowledge the following represents the constitution of the urine in health:—

TABLE OF THE NORMAL CONSTITUENTS OF THE URINE.

Organic Constituents—
Urea
Creatinine
Xanthine

Inorganic Salts—
Soda
Potash
Ammonia
Magnesia
Lime
Iron

Organic Acids—
Uric acid
Hippuric acid
Phenylic acid
Taurylic acid
Damaluric acid
Damolic acid

Inorganic Acids—
Sulphuric acid
Hydrochloric acid
Phosphoric acid
Silicic acid

Urinary Pigments—
Urohæmatine
Uroxanthine
Uroërythrine

In the rapid strides which animal chemistry is making, it would be a manifestation of a want of faith in the progress of chemical science, to expect that the analysis of the urine, as now given, will continue to represent our full knowledge of its constitution. There are even now certain constituents whose chemical composition is as yet unknown, and which are, for the want of a more definite knowledge, known only by the vague terms of "undefined principles" and "extractives." I look forward with perfect confidence to the time when these "undefined principles" will, in the progress of chemical science, receive a perfect solution and be reduced to formulæ as accurate as that which represents the chemical constitution of urea. I have equal faith in my impression, that the future of animal chemistry will bring to light other and, as yet, undiscovered principles of the urine, and that the list of urinary constituents will be swelled by additions to our knowledge, of secondary importance only to the great principle of urea. My present object, however, is not with these "undefined," and with these probably undiscovered, principles, but with those which have already been discovered, and whose chemical constitution is well understood. With such my object is, to ascertain to what extent they are increased, decreased, or in any way modified by disease, and to apply the knowledge thus obtained to the mitigation of human suffering and to the removal of its cause. Much information may be gathered by watching, at the bedside of our patients, the fluctuations which these urinary constituents undergo from day to day, the particular periods of the disease at which they occur, and by associating them with the change in degree of symptoms with which they are accompanied, the nature of the disease which exists, and the particular organ which is affected. In this sense the aim and scope of this paper are practical.

QUANTITY OF URINE IN DISEASE.

The quantity of urine in disease must be determined by reference to the quantity which is discharged by the healthy body in a given time. Now, the quantity of urine secreted by a healthy adult has a certain range, and is influenced by certain conditions. Under the ordinary conditions of life the quantity may, for the winter, be noted as forty ounces in the twenty-four hours; and as thirty ounces for the same period during the summer. The cause of the

difference between the two seasons is due to the increased action of the skin during the summer, by which an excess of fluid is carried off, with the effect of producing a proportionate reduction in the quantity of fluid secreted by the kidneys, but by no means in equal ratio to the excess of fluid lost in perspiration. Season nevertheless does influence the secretory action of the kidneys. The particular nature of the food, the quantity and particular kind of drink, exercise, and rest, have likewise their influence. The fluctuations thus produced in the quantity of urine have a healthy range; or, in other words, the quantity of urine may, by these circumstances, be increased or diminished for a given time without being accompanied or followed by the least injury to the system, or by the slightest deflection from health.

Amongst other causes which influence the secretory action of the kidneys, are mental emotions and anxiety of mind.

What physician has not witnessed the effect of sudden grief or joy in producing an excessive secretion of pale, limpid urine, especially in the female constitution? What medical man has failed to observe, if not in his own person, at least in the persons of others, the increased action of the kidneys caused by the anxiety of mind attendant on an impending examination which is to determine the admission or non-admission of the candidate to medical practice?

If the waiting-room, or, what is more commonly called by medical students, the "funking-room," of the College of Surgeons could relate its experience on this particular point, it would give innumerable instances in which candidates, during the short time they were necessarily detained before being ushered into the examination-room, were repeatedly—nay, almost constantly—discharging the contents of their bladder. Now, the condition of system which gives rise to this increased secretion of urine is, in my opinion, neither one of perfect health nor yet of absolute disease. I would, if requested to define its position in medicine, place it on the boundary line between health and disease—a point from which a continuance of the condition would assuredly result in absolute disease; whilst the withdrawal of the cause and the consequent subsidence of the excitement would as assuredly be followed by a return to the previous state of health. This view seems to derive a certain confirmation from the fact, that headache, a sense of exhaustion, and, in many instances, loss of appetite, follow this condition in both the successful and unsuccessful candidates.

If we now advance a step further, and thereby tread within the verge of disease itself, we arrive at the consideration of the influence which hysteria exerts upon the quantity of the urinary secretion. Immediately after the invasion of the attack, in which the more evident symptoms of the affection manifest themselves, the discharge of urine is frequent, and amounts, in the short space of one or two hours, to three or four quarts, or even more. It is always, under such circumstances, extremely pale, scarcely deeper in colour than water, of a very low specific gravity, seldom exceeding 1·007, and faintly acid to test-paper. But this excessive secretion of urine is not constant. It is soon followed by a manifest reduction of the quantity of urine below that of health. The urine now secreted forms a decided contrast, not only in quantity, but also in colour and density, with the urine previously discharged. Not more than four, six, or eight ounces are voided in twenty-four hours. The colour is generally of a deep yellow or reddish-brown, and the specific gravity often reaches 1·028-30. On cooling a heavy sediment of urates intermixed with purpurates in largely increased quantity is thrown down. These appearances are followed by a return to the natural condition of health, although that condition may not be reached for some days after the cessation of the more urgent symptoms which marked the attack. It may here, in the interest of diagnosis, be asked, whether the excessive secretion of urine and the particular character of the fluid as just described, are diagnostic of hysteria? The proper answer to such a question is—that they of themselves are not, that they are a great assistance in the diagnosis of hysteria, and that, where the more prominent symptoms of hysteria are present, they render the diagnosis certain. The practical inference which flows from this conclusion, in reference to diagnosis, is—that the physician should never declare the presence of hysteria from the mere inspection of a large quantity of limpid urine suddenly discharged by his patient.

Closely allied to hysteria, in the effect produced upon the quantity of the urinary secretion, are neuralgia of the cranial nerves and rheumatism of the scalp. In severe tooth-ache, in tic-douloureux, and in severe neuralgia of the supra-orbital nerve, the quantity of urine discharged, after the invasion of the disease, is frequently, but by no means always, in excess of the natural amount. In rheumatism of the scalp, which is of frequent occurrence, but which is not always recognised, the effect upon the quantity of urine is

often rapid and considerable. The disease is generally ushered in by slight indications of cold, followed by a degree of soreness or pain across the brow and at the back of the head, with, not unfrequently, a sense of stiffness of the muscles at the back of the neck. The pain and soreness increase from hour to hour, almost from minute to minute—any motion of the scalp aggravates the pain—the mere effort of evacuating the bladder, but especially the effort of defœcation, produces throbbing of the vessels of the scalp—nausea occurs—vomiting soon supervenes—the pain grows rapidly worse—and the patient becomes almost distracted. During the establishment of these symptoms frequent micturition occurs, and a large quantity of urine is discharged in a very short time. This, like that of hysteria, may amount, in three or four hours, to a gallon or more; it is of the same pale colour, and of similar specific gravity. On the day following the attack all the urgent symptoms have subsided, and the urine has fallen to its natural quantity, or even below it. It is no longer pale and limpid, but of a deep yellow or reddish-brown colour, of the specific gravity of 1·026-30, and deposits, on cooling, a copious sediment of urates so intermixed with the purpurates as to give to the deposit a red-brown or pinkish-red colour, and to leave on the bottom of the containing vessel a coating of a bright pink character in appearance.

In the cold, shivering stage of the commencement of acute disease, as in the different fevers and local inflammations, the quantity of urine is not unfrequently increased for a few hours, or until the stage of reaction occurs. When such is the case, the cause is due to a temporary loss in the balance of the circulation between the surface of the body and the internal organs—the vessels of the skin containing, at this particular juncture, less than their natural quantity of blood, whilst those of one or more of the internal organs contain more than their natural quantity. When this overplus of blood falls upon the vessels of the kidneys, which is often the case, it at once excites the conservative power of those organs, and an increased quantity of urine is the result. As soon, however, as the hot stage of fever, or that sympathetic fever which is the accompaniment of local inflammation, has been established, the quantity of urine undergoes a manifest diminution. This diminution continues until the acme of disease has been reached, when, if the attack is to end favourably, there is a return firstly, to the natural quantity; and secondly, an increased quantity of urine is secreted. These fluctuations bear a more or less proportionate ratio to the

severity of the attack. By applying our knowledge of the duration of disease to this fact, we are enabled to say when, in cases about to recover, a favourable change ought to be expected in the quantity of the urine. If this change does not occur at the expected period, the prognosis is less favourable than before; but it must not necessarily be inferred that the patient will not recover. It nevertheless shows a persistence of the disease in all its severity, and with it more danger to life from the continual addition to the local effects and to the depressing influence produced upon the vital powers. It further shows that convalescence will, if the patient ultimately recover, be deferred beyond the usual period, and that it will advance towards perfect health with a slower and less decisive step. It must not, however, be forgotten that our knowledge of the duration of disease is not yet so complete as to enable us to determine, with perfect certainty, the exact time which the different diseases occupy in reaching their utmost severity or climax. Until we have attained this perfection of knowledge, our predictions as to the day on which an increased quantity of urine may be expected, and our prognosis as determined by the quantity of urine which actually occurs on that particular day, are liable to a certain amount of error. It is true that, in the different forms of fevers, whether eruptive or otherwise, we know the exact period of time which they occupy in their invasion, in their increase, in their acme, and in their decline; but our knowledge is not so exact and precise as to the duration of local inflammations. Much here depends on age, constitution, temperament, habit, the particular organ affected, the type of disease, and the treatment which has been adopted. This, however, is certain—that so long as the quantity of urine remains at the lowest point which it has marked since the invasion of the disease, that disease exists in all its severity; and that as soon as the quantity of urine does exceed the lowest point at which it has previously stood, the tendency to recovery is thereby noted. How much valuable information may be obtained—how greatly may our prognosis be strengthened—how many sorrows may be soothed, by simply measuring, from day to day, the quantity of urine discharged during the progress of acute disease!

If we turn to the effect of chronic disease on the quantity of urine, we find it to be by no means so certain as that of acute disease. Sometimes the urine is increased in quantity; at other times it is diminished, in the same disease. In the different diseases which involve the digestive organs, the daily discharge of

urine is not only unequal, but it undergoes various fluctuations in the same disease. Diabetes mellitus is usually productive of a large increase in the quantity of urine, which amounts at times to three or four gallons, or even more, in twenty-four hours; but diabetes nevertheless frequently exists with no increase, under proper treatment, in the natural quantity of the urine. Organic diseases of the stomach tend to a diminution in the quantity of urine—a fact which may be explained by the general intolerance of food and of drink which is manifested by the stomach under such circumstances.

I have not unfrequently observed that, in sudden congestion of the liver, in the early stage of simple enlargement, and in commencing cirrhosis, of that organ, the secretory action of the kidneys was increased to a certain extent. It is, however, no less true that, when organic diseases of the liver have acquired a certain status, the urine often undergoes a manifest diminution in quantity, which becomes less and less as the original disease becomes worse and worse, until, in many instances, a few ounces only are discharged in the twenty-four hours. The same may be said of the influence which diseases of the heart exert upon the quantity of the urinary secretion. In the outset of simple hypertrophy, as well as in that of diseases of an obstructive character of this organ, a certain turgidity of the blood-vessels of the kidneys is produced, which results, for the time being, in an increased quantity of the natural secretion. As these diseases increase in severity the turgidity of the renal vessels becomes more and more marked; this ceases to excite the secretory action of the kidneys, and a consequent diminution in the quantity of urine takes place; or a low exudation—the result of this congestion—is poured out, the tissue of the kidney becomes gradually invaded by it, disease of that organ itself is thus superadded to the original mischief, and an increased diminution in the quantity of urine occurs. In all diseases of the kidney of an exudative character, the tendency is, to a diminution in the natural quantity of the urine; because such diseases invade by deposit the ultimate structures of the organ, injure them and disorganize them, and thus render them unable, in proportion to the extent of mischief they have sustained, to discharge their proper functions. The influence of tumours on the urinary secretion is, where they offer no obstruction to the circulation, of a negative character; nevertheless there are not wanting instances in my own practice, in which a sudden and copious discharge of urine was

followed by the disappearance, at least for a time, of an ovarian tumour. It may here be very properly asked, whether or not diseases of the skin increase or diminish the natural action of the kidneys. A priori reasoning, based upon our knowledge of the quantity of fluid which is daily cast off by the skin in the form of sensible and insensible perspiration, would lead us to the inference, that diseases of the skin would, by arresting this natural escape of fluid from the system, and by thus throwing it upon other secretory organs, increase, during their continuance, the daily discharge of urine. Experience, however, does not confirm this natural inference; but here again experience has not yet recorded the results of a long and carefully observed series of investigations, without which it were impossible to give either a direct negative or an affirmative to this question.

DENSITY OF URINE IN DISEASE.

The density of the urine in health has, like the quantity, a considerable range, in which it is greatly influenced by the nature and quantity of solid food and of drink which are taken, by age, and by the amount of bodily exercise which is undergone. This range may be said to extend from 1·007 to 1·030. Within these two extremes the more common range of specific gravity is from 1·016 to 1·024—the former density being favoured by a diet embracing a preponderance of vegetable food, simple drink, and by little bodily exertion—the latter, by a greater proportion of animal food in the diet, by moderate quantities of fermented drinks, and by an ordinary amount of bodily labour. The extreme range of 1·030 is never, at least so far as my own experience goes, reached, except under the use of a highly animalized diet, and even then it is of seldom occurrence; nor have I ever observed the opposite extreme of 1·007, except under some exceptional conditions of body, or of food, or of drink. It may be very positively asserted, that these two limits of the density of healthy urine are much more frequently associated with disease than with the natural conditions of the body; but inasmuch as they are at times found to exist with the latter state of health, they are here simply noted as its extremes of urinary fluctuation; whilst their practical application has far greater reference to disease.

Now, we find that, as a rule, those diseases which increase the quantity of urine, reduce its specific gravity; or, in other words,

they reduce the relative proportion of the natural solids to the fluid portion of the urine, and thus lower its density. This latter mode of stating the proposition is probably the more correct one; because diabetes mellitus increases the quantity of urine, and with it the density of that secretion, much more than any other disease; but the tendency of diabetes is, nevertheless, to reduce the relative ratio of the natural solids to the fluid part of the urine.

Amongst diseases, the tendency of which is to reduce the specific gravity of the urine, are the different nervous affections, as neuralgia, hysteria, rheumatism of the scalp, granular degeneration of the kidneys, the phosphatic diathesis, the cold stage of commencing fevers, and, in many instances, that period or stage of collapse which ushers in a local inflammation. The degrees of limit within which these diseases influence the density of the urine are 1·002 to 1·016-20, the simple neuralgiæ and other nervous affections influencing the urine in the direction of the lower degree of density; whilst the granular degeneration of the kidney, the phosphatic diathesis, and with this latter the oxalic acid diathesis occasionally combined, and the cold stage of commencing fevers and inflammations, tend to push the urine in the direction of the higher degree of density. In the latter division of these diseases, granular degenerations of the kidney render the density of the urine intermediate between that produced by the purely nervous affections on the one hand, and that which, on the other hand, is the common density associated with the phosphatic diathesis and with the very earliest stage of disease of a purely inflammatory type. Hence, the density of the urine in albuminuria is generally from 1·007 to 1·012-14. Although the commencement of many diseases is associated with a diminished density of the urine, yet the tendency of the great majority of those diseases is, as they approach their termination, to increase the density of that fluid. This is true of the pure neuralgiæ, hysteria, rheumatism, fevers, and inflammation generally; but it does not apply to the progressive advance of granular degeneration of the kidneys, the influence of which is, from first to last, to lower the specific gravity of the urine. So true indeed is this remark that, were an opinion as to the nature of the disease required to be formed from the specific gravity only of the urine, granular kidney would be at once suspected, provided the density stood at 1·008, or from that to 1·012. With the same precision and exactitude, diabetes mellitus would be strongly suspected, if the density of the urine reached 1·033; but its existence

would be rendered certain if, on taking the specific gravity of the urine, its density were found to reach 1·040; because no other disease with the occasional exception of chylous urine, ever raises the density of that secretion to this high degree. In fevers, both eruptive and non-eruptive, and in inflammation of the different organs, no sooner is the disease established than the urine increases in specific gravity; and it, as a rule, never again, from that moment to the termination of the disease, falls below its usual standard of health for each individual case. It may, however, have, between the period of the establishment of the disease and the termination in recovery or death, certain fluctuations, which have their significance, and which, when judged in connection with other indications, afford valuable information as to the grounds for prognosis; but to whatever specific gravity these fluctuations lead, the density of the urine is invariably as high as, and almost always higher than, that of the urine of the same person in health. This rise in the specific gravity is, in the first instance, due to the presence of an *increase of urea* and of the colouring matters of the urine; and, in the second instance, when the disease tends towards recovery, to the presence also of the urates of the alkalies in increased quantity. If the disease shows no disposition to terminate in recovery, then the continued increase of density is maintained throughout by the urea and colouring matter before named; but chiefly by the urea itself. If it fluctuates in its tendency between recovery and death—at one time showing a disposition to terminate in the former—at onother time, to end in the latter—the increased density is maintained throughout the two phases; but, in the former, it is due to the presence of urea and the urates—in the latter, chiefly to the urea as before described.

There is no disease in which the density of the urine fluctuates more than in pulmonary consumption. At one time it shall not exceed 1·007; at another time it ranges within the ordinary limits of health; again it equals 1·026-30. When the density is low, it is generally associated with pain in some part of the body, with abstinence from food, and with the ingestion of more than the usual quantity of fluid. Here the nervous excitement seems to increase the secretory action of the kidneys, the Malpighian bodies filter off a large quantity of fluid, and thirst is excited beyond the ordinary degree in such disease, to compensate, by an increased quantity of drink, for the augmented flow of urine thus produced. Such instances are more common in the female than in the male

constitution, and in girlhood and adolescence than in adult life. When the density of the urine ranges within that of ordinary, healthy urine, it will be found to depend on an improved condition of the digestive organs and of the general health. Such improvement occurs only in the more chronic—never, or very rarely indeed, in the acute form of pulmonary consumption. It is a matter of well accorded observation, that dyspepsia often precedes, for some time, the deposit of tubercle in the lungs—that at one time it is better, and that at other times it is worse—that the weight of the body increases and decreases with these alternating conditions of the digestive organs—and that the density of the urine observes a similar ratio. In progressive cases the periods of aggravation outstretch those of improvement—the weight of the body has, at the end of a given period, greatly diminished—and the products of the imperfect digestion and assimilation of food, and the compounds resulting from the waste of tissue, being thrown upon the kidneys, an increased density of their secretion is the result. Still, times and periods of improvement, however short, do occur, in which the digestion and assimilation of food are more complete, the body ceases to waste, and the density of the urine is diminished. During the period of pulmonary deposit there are certain phases or epochs which mark the advent of fresh crops of tubercle; and certain periods of repose, which mark the temporary cessation of the localization of tubercle. The former are productive of urine of increased density—the latter, after a time, restore it to the patient's general standard of health. In the softening of tubercle and the consequent formation and subsequent extension of caverns, there is great waste of tissue, the organic compounds resulting from the breaking up of which and from the recombination of its elements, appear more particularly in the urine, the specific gravity of which is in consequence raised to 1·026-30. At this stage of the disease the urine generally maintains a high specific gravity, which is a sure indication of the progressive waste of tissue and of the certain and advancing step of death.

If we regard the urine in the acute forms of pulmonary consumption, we find that, as a rule, it manifests a high specific gravity from the commencement of the disease to its close. This density varies from 1·018 to 1·030, its more frequent specific gravity being 1·026-28. In this respect it closely approaches the density of the urine in local inflammations of an acute character; but its continuance is much longer than that of the latter. It is

also co-ordinate with the density of the urine in the last stage of chronic pulmonary consumption, when hectic fever has supervened, and when the lungs are undergoing rapid disintegration. It is, however, more persistently high in the acute than in the closing stage even of chronic pulmonary consumption; because there is, in the former, no cessation of those signs and symptoms which denote the constant advance of disease; whilst there is, in the latter, a daily fluctuation of indications which sometimes show a diminution in the severity, and consequently a partial abatement of the destructive action of the disease, under which the density of the urine falls. Given a case of pulmonary consumption, the daily observation of the density of the urine, for a short time, would enable the physician, without reference to any other indications, to determine whether or not the form of the disease was acute or chronic, and with what degree of rapidity it was advancing. If the urine passed at all times during the twenty-four hours were of similar specific gravity, and if that specific gravity were from 1·026 to 1·030, and if that density were found to be constant for ten or fourteen days successively, there would, from this simple fact alone, be no difficulty in pronouncing the case to be one of acute pulmonary consumption. If, on the other hand, the morning, mid-day, and night urine, varied in specific gravity; if, at one of these periods that specific gravity were 1·016; at another period, 1·020-22; at a third period, 1·026-28; and if these fluctuations were observed for ten or fourteen days in succession, the existence of chronic pulmonary consumption might, in such a case, with confidence be pronounced. By observing these fluctuations, and by noting their tendency or otherwise to approximate their densities in the one or other direction of the higher or lower degree of specific gravity which the urine had reached, the progress of a case may be determined. If, for instance, the specific gravity of the urine, after having manifested for a time the diurnal revolutions of density before described, tended throughout the twenty-four hours of day and night, to the highest degree of specific gravity already given, the certain indication would be—that the disease was progressing with a steady increase. If again, the specific gravity of the urine tended, under the circumstances of diurnal revolution just stated, to the lowest degree of density, and if it thus continued from day to day, it would show as positively that the progress of the disease had received a temporary check or abatement.

In diseases of the digestive organs, whether of an organic or of a

functional nature, as well as in other diseases in which these organs are wont to be greatly disturbed, as in gout and acute rheumatism, the specific gravity of the urine varies considerably. In dyspepsia the tendency of the affection is, to raise the specific gravity of the urine, because the food taken into the stomach cannot undergo that complete digestion which is necessary for the formation of healthy blood; and being, therefore, incapable of assimilation by the tissues of the body, it simply undergoes those transformations which direct its elimination by the kidneys, through which it passes more especially as the urates of the alkalies, and thus increases the specific gravity of the urine. In that form, however, of dyspepsia which is distinguished by the epithet "irritable," the specific gravity of the urine is often suddenly diminished. When such is the case, it follows pain of the stomach consequent on the ingestion of food, the excitement of which, being apparently transmitted through the great sympathetic to the renal plexus of nerves, rouses the secretory action of the kidneys, and thus induces an increased secretion of urine, the specific gravity of which is consequently below the natural standard.

In the early stage of organic disease of the stomach, as in scirrhus of that organ, the urine is generally either of the natural density or several degrees below it; but no sooner has the stage of ulceration arrived, than the specific gravity shows a tendency to increase. For this change an easy explanation is found in the fact, that the disintegration which, at this stage, is advancing in the walls of the stomach, and the, probably, consequent absorption of morbid matter into the veins—the powerful impression which is, by the presence of cancerous elements in the blood, made upon the structures of the body in diminishing their vitality, and in thus favouring their dissolution—and the effect of a diminished supply of food and of the imperfect digestion and assimilation of the very small quantity which the stomach is, at this juncture, able to retain, determine an increased amount of solids to the kidneys, through which, in their transformations into urea, uric acid and its resultant salts with ammonia, potash, and soda, as also into purpurine, pass off by the urine with a necessary increase in the density of that secretion. Hence the daily observation of the specific gravity of the urine would, in such instances, become, to a certain extent, the measure of the progress of the disease. This fact, true with respect to disease of the stomach, is no less true of the morbid affections of the liver. In hypertrophy, in cirrhosis, in cancer, in tubercle, in

abscess of that organ, when the resultant obstacle to the portal circulation has become well marked, the renal vessels become, not as a necessary consequence, but as a co-ordinate condition, turgid with blood surcharged with material, part of which ought, in the common course of healthy action, to be eliminated by the liver, but which, owing to disease of that organ, and to the consequent interruption to its function, is now cast out of the body by the kidneys, with the necessary effect of increasing the density of the urine.

Such, too, is the effect of any mechanical obstruction to the flow of bile from the biliary duct into the duodenum. Here, the obstructed action of the liver is, in the manner just stated, supplemented by a vicarious action of the kidneys, by which a portion of the bile is removed with their natural secretion, which thus acquires an increased density in proportion to the quantity of biliary matter present. Bile, per se, always increases the density of the urine; but the urine may contain bile, and yet its specific gravity shall not exceed the specific gravity which the urine itself would, under ordinary circumstances, have acquired without any admixture whatever of bile. This sometimes occurs in the passing of gall-stones, when the pain is not only severe, but more or less persistent for hours. The nervous excitement produced by the pain of an impacted biliary calculus, is reflected through the sympathetic nerve to the kidneys; their secretory action is thus inordinately excited; a large quantity of fluid is secreted; the bile, being already prepared and existing as such in the renal vessels, is at once filtered off in preference, as it were, to the natural constituents of the urine; and thus, the increased density produced by the presence of bile being neutralized, or more than neutralized, by the more or less absence of the urinary solids, a urine, impregnated with bile, may be passed without its specific gravity exceeding, or, in some instances, even equalling, that of the urine of health. Such, however, is the exception to the ordinary result; and, therefore, the rule must always be—that the presence of bile in the urine increases the density of the latter secretion.

If we compare the influence of heart-disease with that of disease of the digestive organs on the density of the urine, we find that it is much less in the former than in the latter. When heart-disease is not producing any of the secondary results which usually flow from it, the density of the urine may remain natural for years. When it simply causes a gentle turgesence of the

renal vessels, without any show of dropsy of the lower extremities, or any portal engorgement, the urine is slightly increased in quantity, and either natural or slightly diminished in density; but when it offers to the blood returning to the right side of the heart a sufficient obstruction to cause a back-flooding upon the portal vein and its tributaries, and upon the inferior vena cava, the urine is diminished in quantity, but generally increased in density. Similar results, although somewhat different in degree, are associated with the existence of abdominal tumours. So long as these do not interfere with the natural functions of the abdominal organs, the density of the urine is uninfluenced by them; but when, from the growth which they have acquired, and from the consequent pressure and displacement of the abdominal organs, digestion is impeded, and the natural secretions are disturbed, the specific gravity of the urine exceeds its usual limits, and not unfrequently reaches 1·030. Tumours of a malignant character, from their more rapid growth, by which pressure and displacement are more suddenly brought about, and from the more depressing influence which they exert upon the vital powers, more readily and more quickly influence the density of the urine than tumours of a benignant character. I have seen a tumour, diagnosed as omental and harmless in its nature, exist for years with scarcely any increase of growth, and without influencing, in the slightest degree, the urine in either its quantity or specific gravity. Mesenteric tumours, on the contrary, which are often malignant, frequently grow rapidly, and by their influence on the digestive organs and on the circulatory system of the abdomen, render the urine, even from the moment of their possible detection, of higher specific gravity than that of the healthy secretion; whilst ovarian tumours may continue to grow for months, and may even attain a considerable size before the urine is at all effected in its density. Hence, in a case of abdominal tumour surrounded by doubtful symptoms, the diagnosis may be assisted by closely watching, for a short time, the density of the urine.

It has been already stated, that gout and rheumatism greatly influence the specific gravity of the urine. Under their influence, in their acute character, the density often reaches 1·030, below which it seldom falls further than 1.026 until the attack ends in convalescence. In muscular rheumatism and in masked gout, in which there are flitting pains and but little disturbance of the general system, the density of the urine varies considerably. At

one time, when pain is more urgent than usual, there is diminished density with increased quantity of urine; at another time, the urine is of ordinary specific gravity and quantity; and again, on other occasions, the density rises to 1·028 or 1·030. The last mentioned density must always be accepted in a favourable light; because it shows that the kidneys are eliminating from the blood those morbid elements upon the presence of which in the tissues the gout and rheumatism depend.

COLOUR OF URINE IN DISEASE.

It has been shown that both the quantity and the density of the urine are greatly influenced by the different diseases to which the human body is liable. It is no less true, that the colour of the urine is, in like manner, affected by disease. To appreciate the changes which it undergoes in this respect, it is necessary to have a proper conception of what, under the ordinary conditions of life, constitutes the standard of colour in healthy urine. Now, the basis of the natural colour of healthy urine is yellow, or what is understood by the term—straw-colour. Of this, three shades may be recognised — the light, the moderate, and the deep yellow. Through all these shades the urine, in health, presents a bright sparkling appearance, which is due to the reflection of light from its surface, and to the refraction of light as it passes through the fluid. The less the quantity of light absorbed by the urine the brighter is its colour; and, on the contrary, the greater the quantity of light absorbed by it, the duller and deader appearance does it present to the eye. This latter condition is due to a giving way of those molecular forces which hold the organic atoms of the urine in vital bond; or, in other words, it is expressive of commencing decay in such atoms. This change is attended by increased absorption, and by diminished reflection and refraction of light, thus causing a duller appearance to be given to the urine. To speak, then, of the vitality of the urine after its emission from the body, would be but a co-ordinate term with that which expresses the vitality of a muscle from the period of somatic death to its organic disruption by chemical change. The body dies; for a certain period afterwards the muscles contract under the application of galvanism as they did in life under the stimulus of the will. This is the expression of an inherent vitality in the muscles themselves. It is in fact organic life, which remains for a time

with the body, after life, in its more spiritual conception, has passed away. Putrefaction at length commences; the muscles become soft and diffluent; their fibrillæ break down; they lose their organization; they can no longer respond to the stimulus of galvanism; their organic life is at an end. In like manner, and for similar reasons, there is for the urine, after its emission from the body, a period in which it undergoes no change. Its physical properties, its organic constituents, its chemical re-actions continue for a time unaffected, uninfluenced by those chemical agents which are continually destroying inanimate organized matter, and as continually rearranging and recombining its elements in other forms. Does not this period of the maintenance of the urine's integrity depend on an inherent vitality in its organic constituents? These at length give way; they are broken up and resolved into their ultimate elements; these elements are recombined and thus form compounds foreign to the natural constituents of the urine; the physical properties of the urine are thereby altered; its chemical action is changed; its integrity is destroyed; it is, in fact, no longer urine, but a putrid, fœtid, dead, disorganised fluid. Let us, then, carry with us the idea of life in the urine, and it will assist us in explaining the optical changes which are produced in it by disease.

Now, from the standard of colour which has been fixed for healthy urine, there are two divergences which are produced by disease. The one has reference to a deeper—the other, to a lighter colour than that of the urine in health. Each has its particular significance in reference to diseases of which it is a consequence. This significance must be sought and determined, in order that the knowledge thus obtained may have its practical application to diagnosis and to the therapeutics of disease. Taking the lowest standard colour of healthy urine for comparison, we find that some diseases cause the colour to diverge from such standard to the condition of almost a colourless fluid like water. What, then, it may be asked, are the diseases which produce this effect on the urine? Experience teaches us, that they are the purely nervous—diseases also, which, during their course, either temporarily or permanently affect the nervous system and, in many instances, the digestive organs as well—and diseases of the kidneys themselves. The modus operandi is not the same in the different diseases which produce a pale urine, although the result in all may be more or less uniform. In one class of diseases

producing pale urine the want of colour is due to the presence of an excess of water—in another class, to a relative deficiency of the natural solids of the urine, of which the colouring matter is one—in a third, to both of these causes combined. The urine of neuralgia, of hysteria, and of cranial rheumatism, illustrates the first—the urine of degenerated kidneys the second—and the urine of chronic diabetes mellitus the third. These have one character in common—that of a pale colour, almost as light as water; but here their analogy ends. They are widely different as to their densities; they are different in their chemical constitution; and they differ as to their pathological cause. The urine of neuralgia and of hysteria may have a specific gravity of 1·002-7 only—that of degenerated kidneys 1·010-12—that of chronic diabetes 1·045-50. The chemical analysis of the first shows a deficiency only of the natural solids—that of the second, an impregnation with albumen, with a less deficiency of the natural solids—that of the third, the presence of sugar with or without, but generally with, a reduction of the natural quantity in the urinary solids. Again, in the first, the pathological cause is mere nervous disturbance of the kidneys—in the second, absolute disease of the kidneys themselves—in the third, irritation of the floor of the fourth ventricle of the brain according to Bernard; a perverted action of the liver, by which its glucogen is converted into sugar according to others. What, then, is the practical inference to be drawn from these facts? It is this—that pale urine is not diagnostic of any particular disease. Let the physician, then, be careful how he, on being shown a quantity of pale urine, expresses an opinion as to the nature of the disease from which his patient suffers. The specific gravity must be noted; albumen and sugar must be sought by the usual tests; the microscopic appearance of the sediment, if any, must be examined; the quantity of urine secreted within a given time must be ascertained; the colour must be noted; and all these must form elements of calculation in attempting a diagnosis from the mere character of the urine itself.

But there is another condition of the urine, in which that fluid is pale, and in which it differs from the other examples of pale urine already given. It approaches, although faintly, the lightest shade of the standard colour of the urine, with a dash of white, as though a few drops of milk had been distributed through it; its specific gravity ranges from 1·010 to 1·024; it has an acid reaction; and lets fall a curdy precipitate on being

boiled, which precipitate is immediately dissolved on the addition of nitric acid, rendering the urine very clear with the merest tint of bistre in it. Such urine is distinguished by the epithet, phosphatic. If the sediment is allowed to subside, it collects at the bottom of the containing vessel like flocculent snow, and displays under the microscope beautiful prismatic crystals—separate, in groups, in stellary tufts, and often interspersed with octahedra of oxalate of lime. This urine differs from all the preceding examples of pale urine in colour, in specific gravity, in chemical constitution, and in its pathological cause. It is expressive of either functional disturbance or organic lesion of the nervous centres. It is frequently the result of wear and tear of the nervous system. If it occurs in a clergyman, statesman, or person given to deep study, look for the cause in over-exertion of the mind; if in a tradesman, ask about losses in business; if in a young female, interrogate the affections, and you will almost invariably find its cause either in the grief of unrequited love, or in the sorrow and anguish of mind produced by the loss of a dear, departed one. But it does not always occur as a primary result. It occasionally takes the character of an intercurrent affection, variable in its duration, often fugitive, often recurring, and often replacing, for the time being, some constituent of the urine caused by the primary disease. Thus I have seen it occur in the urine of diabetes mellitus of a few months' duration, in which it would appear for a few hours, then disappear for a day, to reappear again and again at short intervals. Its occurrence was invariably marked by the suspension of the excretion of sugar, and its disappearance was immediately followed by the reappearance of sugar in the urine. Occasionally, sugar, phosphate and oxalate of lime, and uric acid in crystals, alternated with one another; and again, the sugar and uric acid existed together—a circumstance of not uncommon occurrence in those cases of diabetes which are not of long standing, in which the quantity of urine is but little in excess, and in which the urinary solids have undergone little or no reduction.

Under this aspect of colour, as to the urine, may be mentioned two conditions, which give to that fluid, on its emission, a more or less milky appearance. The one is where chyle, the other where pus, is present in the urine. In the former, which is of extremely rare occurrence, and which is far more frequently found in warm climates than in temperate latitudes, a quantity of fat in a molecular form, together with albumen, and sometimes with fibrine,

blood-globules, and fatty epithelium from the tubuli uriniferi, is disseminated through the urine. To the action of the alkalies of the urine on this molecular fatty matter the milky appearance of that secretion is probably due. This is removed by an excess of ether, which, by dissolving the fatty matter, renders the urine clear. Sometimes the urine is clear on being voided, but, on standing, coagulates into a jelly-like mass. At other times, whilst manifesting its distinctive character of milkiness, it on cooling assumes a solid form. In the former instance but little fat is present in the urine; whilst there is the usual amount of albumen in such cases. In the latter, both fat and albumen exist in the proportions usually found in this disease. This condition of the urine may or may not be associated with degeneration of the kidneys. When it is not, there is an absence of renal epithelium, casts of the tubuli uriniferi, and blood-globules from the urine. When it is, these almost necessary products of renal disease are superadded to the essential constituents on which the milkiness of the urine depends. It is a notable fact that, during the existence of this affection, the urine is not always in the same individual milky in appearance. At one hour of the day it presents this character; at another, it is quite clear; whilst, shortly afterwards, it returns to its speciality of colour. This colour may be assumed by the urine shortly after a meal, to continue through the day, and to disappear from the urine at night; or it may be present in the urine of the night and of the early morning before food, to disappear after breakfast, and to continue absent during the remaining hours of the day. To what pathological cause are we to refer this milkiness of the urine? It has been known to exist where no trace of disease in the kidneys could be found. It is thus shown to be independent of any affection of those organs. It, on the contrary, is always associated with more or less of malaise, with a falling off in the general health, and with loss of strength. Hence, the probability is—that primary assimilation of the food is not perfected—that chyle passes into the blood without undergoing its usual conversion in the lungs—that the kidneys, as the chief excretory organs of matter foreign to the welfare of the body, take cognisance of its presence in the renal vessels—and that these, partaking of the general relaxation of the vascular system, and indeed of every structure, arising out of the general debility which exists, allow the fatty matter in question, and, with it, a portion of albumen, to filter through their walls, to escape into the tubuli uriniferi, and

to pass off with the urine, to which it gives the peculiar milky appearance already described. What, then, does this view of its pathology inculcate? That, in all such cases, minute regard should be had to the state of the digestive organs, to those circumstances of life which influence them, to the condition of the respiration, and to the state of the kidneys, not in the relation of necessary, but in the light of accidental, disease with which they may be affected. But it does more than this. It further teaches that, in the absence of kidney disease, there exists no pathological cause why the disease should not be cured; but that, where any complication, like that of degenerated kidneys, exists, it is impossible for the patient to recover.

When pus is present in the urine, the latter fluid, although milky in its appearance at the moment of its discharge from the bladder, becomes on standing separated into a supernatant fluid which is clear, and a white sediment, which is seen, under the microscope, to consist of the characteristic pus corpuscles. Now, the existence of these cells in the urine is diagnostic of inflammation of some portion of the genito-urinary mucous membrane. If it occurs in the male in pretty large quantity, the pelvis or the tubuli uriniferi of the kidneys are the probable seat of disease. If it has its origin in the bladder, it is associated with a quantity of thick, viscid mucus, which clings to the bottom of the containing vessel, which, on the inversion of the latter, it quits in one thick, glairy, tenacious, ropy mass. It may, however, have its origin in the bladder without there being any admixture of mucus. This generally occurs when a catheter is left in the bladder for some time; or when the bladder has been kept in a state of more or less distension for weeks by stricture of the urethra. When purulent urine follows the retention of a catheter, the last portion only of the urine drawn off is milky; but when the bladder has been partially distended for some time, and when it is relieved for the first time by the catheter, the urine is more or less milky throughout the whole period of its flow. In acute gonorrhœa the admixture of pus with the urine as the latter flows along the urethra, communicates to the urine only a very faint milky appearance, which is due to the comparatively small proportion of pus which is present. These facts, as regards the male, establish two great points of diagnosis. The one is—that a milky-coloured urine, letting fall a large deposit of pus only, points to suppurative action of the kidneys; the other—that where, with pus, there is such an

admixture of mucus in the urine, that the deposit forms one, thick, glairy, ropy mass, which clings to the bottom of the containing vessel, the lining membrane of the bladder is the seat of disease.

In the female the colour of the urine may be rendered milky in appearance, not only from the causes just mentioned, but also from inflammation of the mucous membrane of the vagina and uterus. This affection is productive of a purulent discharge, which is more common in the married than in the single, which is sometimes profuse, but which is more frequently moderate in quantity, and consequently insufficient to impart more than a slight milkiness to the colour of the urine.

If we now ascend the scale of colour, we find that, in passing from the lowest to the highest standard shade of healthy urine, we approach that of oxaluria. The colour of the urine in this affection is generally of a deep amber—several shades deeper than the deepest colour of healthy urine; but it is also occasionally of a pale straw colour, similar to that which has been the subject of the previous remarks. When with the deep amber colour, the density ranges from 1·025 to 1·030; and when with the lighter colour, the density varies from 1·015 to 1·022; and when, moreover, there are, in the subject of it, great depression of spirits, irritable dyspepsia, pain across the loins, loss of flesh, and considerable prostration, the urine should be examined for oxalate of lime. Such a urine is so frequently the concomitant of great mental exertion, of the continued devotion of the mind to business pursuits, and of the worries and anxieties of professional life, that its existence should be suspected in clergymen, barristers, literati, merchants, and others, who present the general indications above stated.

In still further ascending the scale of colour we come to that which may be termed yellowish-red and brownish-red urine. This is essentially the urine of active inflammation. Between these two extremes there are other degrees of shade through which the urine passes from the acme of inflammation to its decline. These degrees are well worthy of study, inasmuch as they afford valuable information as to the intensity of the inflammation and the progress which it is making either in the direction of recovery or of death. When a local inflammation of an intense character has been established, the urine becomes of a brownish-red colour, is quite clear, has an acid reaction, and is of the specific gravity of 1·028 or 1·030. If the inflammation is less intense, the urine is a few shades lighter in colour in the direction of yellowish-red, and

manifests a specific gravity of 1·026 or 1·028. If the inflammation is still less in degree, although acute, the urine is yellowish-red in colour, and 1·025 or 1·026 in density. In all these instances the urine remains quite clear for an indefinite number of days after being voided—generally, however, from three to five or six—when it lets fall a sediment, flocculent in appearance, and consisting of the urates of the alkalies. Whichever of these shades the urine presents on the full establishment of inflammation, that shade it continues to manifest so long as the inflammation exists in all its severity; but no sooner does the inflammation decline, in the least degree, than the depth of shade in the urine becomes somewhat lighter. By attentive observation we shall often find that this slight change of colour in the urine is the very first noticeable indication of an improvement in the disease. If all other symptoms continue in all their original severity, this change may be accepted as a sure indication of the tendency in the inflammation to subside. It does not, however, follow from this, that the tendency thus expressed will continue. Various causes may arise in the system, by which the inflammation is again aggravated; but with this aggravation the urine invariably loses its improved shade of colour, and again acquires that of its original brownish-red. When, however, the tendency to improve continues, the urine becomes lighter and lighter in shade, reaches a yellowish-red, and thence continues to pass by changes of shade until it acquires the deep yellow or straw colour of healthy urine. The depth of colour of inflammatory urine is due to an excess of the pigment matter of this secretion, and its increased density to the presence of an increased quantity of urea. When such urine begins to lighten in shade *the urea also declines in quantity;* but *the uric acid increases.* Hence, in inflammatory urine, uric acid replaces to a certain extent urea in the declining phase of the disease. This fact is opposed to the views of Liebig, who regards urea as the derivative of uric acid formed from the direct metamorphosis of the nitrogenous tissues. But facts are more reliable than theory; and facts prove that, during the persistence of inflammation, the urea exists in increased quantity in the urine—that as soon as the inflammation begins to decline the quantity of urea becomes less—and that at this moment the uric acid is increased. Now, as the exudation of inflammation consists, like the nitrogenous tissues of the body, of protein compounds, we should expect that, according to the views of Liebig, the metamorphosis of such exudation would first result

in the production of an increased quantity of uric acid, and then in the conversion of the latter into urea, which would thus appear in increased quantity in the urine, and with a reduction of the uric acid at the close of the disease. Hence, the urates ought not, according to this view, to appear in the urine at the termination of an inflammation, but urea in increased quantity. Now, this is precisely the reverse of what really happens. The views of Liebig on this question are therefore untenable; whilst the physiology of clinical facts seems to justify the view, that, in the metamorphosis of the albumen and fibrine of an inflammatory exudation, these protein compounds are first converted into urea, and afterwards in part into uric acid and ammonia, which, as urate of ammonia, constitute the sediment so constantly observed in the urine during the subsidence of local inflammations. But, to revert to the question of the colour of the urine in inflammation, there are several points which assist us in our prognosis. If, in the progress of inflammation, the urine continues of the same depth of colour as it presented on the full establishment of the disease, we know that there is as yet no improvement in the case; but if, on the contrary, the symptoms have increased in severity, and the urine nevertheless presents a bright, clear, sparkling appearance, notwithstanding any increase of depth of colour which it may have undergone from the aggravation of the disease, hope of improvement may still be entertained. Again, it may be stated—that if, without there being any perceptible increase in the severity of the disease, the urine should lose its clear, bright, and sparkling character, and if it should present a dull, dingy, and dead appearance, the condition of the patient may be unhesitatingly pronounced to be worse. Such a change in the urine does not necessarily imply that the patient will die; but it expresses a condition in which there is a tendency to death, and which ought to have its weight both in the prognosis to be given and in the treatment to be pursued. It is due, as has been before shown, to an alteration in the molecular arrangement of the organic matter of the urine in its first steps of decay, under which more light is absorbed, and less reflected and refracted, in its transmission through that fluid.

Now, the colour of the urine which has been given as that which is the associate of inflammatory action, is also a consequence of those diseases which are characterized by an augmented temperature of the body. Hence, in the different forms of fevers, the urine, under the full influence of the disease, is either of a yellowish-red

or brownish-red colour—the lighter shade being generally associated with fever of a milder form, and the deeper shade with fever of a more severe type. The duration of their continuance is governed by the particular type of fever which is present. In simple inflammatory fever they continue only during the urgency of the disease, which may last from one to three or four days; in eruptive fevers, during the growth and the acme of the eruption, after which the colour of the urine tends, under favourable circumstances, to the healthy standard. If at these particular times the urine does not become lighter in colour, a persistence of fever is to be apprehended. If, on the contrary, the urine has deepened its colour, and if it remains clear on cooling, an intercurrent inflammation is either existing or at hand. Although the yellowish-red and brownish-red colours are the characteristic colours of inflammatory urine, yet it must not be forgotten that these colours are particularly modified by acute inflammation of the kidneys and of the liver. In the former, the extreme congestion of the renal vessels arrests, in a great measure, the natural function of those organs, and causes, by continued pressure upon the vascular walls, an escape of blood into the tubuli uriniferi, along which it is washed by the urine, to which, as seen when voided, it imparts a smoke-brown colour. The existence of this kind of urine should always induce the physician, on being called to a patient, to enquire into the condition of the kidneys. Led by the particular colour of the urine, he will enquire into the specific gravity of the latter, the quantity of urine secreted, its behaviour under the application of heat and nitric acid, the microscopic appearance of the sediment which subsides in the urine on repose; and he will further ascertain whether vomiting, which is a frequent symptom of acute nephritis, exists; whether there is any puffiness of the eyelids or of the ankles; what is the condition of the loins as to pain; and whether or not a febrile condition of the system is present. Attention to these points will enable him, without hesitation and without the risk of error, to pronounce upon the state of the kidneys. In the latter disease—*i.e.* inflammation of the liver—the generally inflammatory colour of the urine is marked by the presence of the colouring matters of the bile. Here, as in the case of the kidneys, the extreme congestion of the hepatic vessels arrests more or less the function of the liver, and throws back upon the blood the biliary elements, which are in part directed by the conservative action of the system to the kidneys, through which they pass with

the natural secretion, and appear in the urine, to which they impart a yellowish, or greenish-yellow, or brownish or blackish-yellow, colour, according to the quantity of bile which is present. The occurrence of such urine in a patient ought at once to direct the attention of the physician to an examination of the liver.

In still further considering the question of the colour of the urine in relation to disease, the attention is arrested by that of the colour of the urine in acute rheumatism. In this disease the colour of the urine is of a deep lake red, or brownish-red, which, at first sight, may convey the impression as though a certain quantity of blood were mixed with the urine. Such urine has an acid reaction, is generally of the specific gravity of 1·028 or 1·030, and lets fall on cooling a heavy sediment of the urates deeply stained with purpurine. Purpurate of ammonia is also present to such a degree that a pink circle of it is deposited around the bottom and sides of the containing vessel. It is from the presence of this constituent that the urine acquires in acute rheumatism the peculiar colour just stated. In other forms of rheumatism, and especially in that form which seems to centre itself in the nerves of a part, this highly coloured urine not unfrequently occurs. The remembrance of this fact may at times serve to elucidate and to explain the character of a pain, of the nature of which some doubt may have been felt. Let me illustrate by a case. A patient is seized with a pain in the side or in a particular part of the abdomen; it is fixed and constant; pressure or motion aggravates it; but the general disturbance of the system is so slight that there is no increased heat of the skin—no thirst—no interference with the appetite. The pain, however, continues; it is still fixed; the affected part has become more painful on pressure or motion; there is no thirst; still, the appetite is not as good as it was; the tongue is a little furred; but the urine is natural. Very shortly afterwards the pain ceases rather suddenly, or it remits for a short time and then ceases; the urine next voided is of a brown-red colour; and a sediment of a lake colour forms in circles at the bottom, or entirely covers the bottom, of the containing vessel. Again—pain of a similar character attacks the bowels or the bladder; there is as before an absence of general symptoms; but with the pain in the bowels there is by-and-bye a tendency to diarrhœa; and with pain in the bladder a rather frequent desire to micturate, accompanied by a constant sense of uneasiness behind the pubes; whilst the attack in both instances terminates with the

deposit of a pink sediment in the urine. Now, the presence of this deposit may be accepted as a sure sign that the pain in question was rheumatic in its character. But this deep lake coloured urine is not confined to rheumatism alone; therefore its presence must not be regarded as pathognomonic of that disease. In organic and other diseases of the liver, as well as in delirium tremens, it is likewise of very common occurrence; and in diseases of the lungs and of the heart it is not unfrequently seen as a morbid constituent of the urine. When, however, its presence is associated with heart disease, it is, in my opinion, more dependent on the rheumatic constitution in which the heart disease finds its probable cause, as well as on a perverted function of the liver produced by the back-flooding from the right side of the heart, than upon the heart disease itself, simply considered as such. In other affections than these it seldom occurs. Hence, its existence in the urine is at all times suggestive of rheumatism, of hepatic disease, of delirium tremens, of affections of the lungs, and of disease of the heart; but the question, as to which of these organs is, in each particular instance, at fault, must be determined by reference to other symptoms and special indications.

AËRABILITY OF THE URINE IN DISEASE.

There is one physical condition of the urine in disease, which has commanded but little attention, but which nevertheless is well worthy of notice. It is the capability of the urine, on being shaken in a bottle, to maintain the frothy head caused by air imprisoned in the form of bubbles on its surface. The duration of this capability varies in the urine of certain diseases. It does not depend upon the density of the urine; but it is owing to the presence of substances which are chiefly foreign to the natural constitution of that fluid. At the head of such substances stand sugar and albumen. When urine containing either the one or the other of these substances is shaken in a bottle which is afterwards kept corked, the head of the air-bubbles thus produced will not entirely break and subside for upwards of twenty-four hours. Saccharine urine manifests a greater capability of maintaining these bubbles than does albuminous urine. Hence, diabetic urine possesses the property of aëration in the greatest degree; next the urine of diseased kidneys containing albumen; then urine containing bile, and the urine of fever in which albumen is present; after which the capability of

aëration may be said to depend on the quantity of urea which is present in the urine. We thus come to the urine of the first stage of inflammation, in which the quantity of urea is greater than in any subsequent stage of the disease, and in which the aërability of the urine is in consequence proportionately greater than in the latter. Where the urine of disease contains no other than the ordinary constituents of that fluid, the capability of aëration is in proportionate ratio to the quantity of organic matter present in the urine. This organic matter, as well as sugar and albumen, imparts to the film, which encloses each air-bubble, a cohesion, which enables it to resist the expansive power of the air within it, and, when the fluid is exposed to the atmosphere, the pressure of the latter upon its surface, in a much greater degree than the film of a mere bubble of water in which no such organic matter or substance is dissolved. If, at the time of the emission of the urine, the vital forces of this organic matter are beginning to diminish, and if, in consequence, the complete disruption of its molecules is impending, the film with which it surrounds the bubbles of air is less cohesive, and consequently the bubbles themselves are less persistent, than those which are formed by the shaking of urine in which its organic constituents have as yet undergone no molecular change. This fact teaches us, that a daily comparison of the aërability of the urine in disease would at times afford valuable aid to the physician in forming a prognosis, But the comparison, to have this desired effect, must be made between specimens of urine of the same temperature; because the. difference of a few degrees only of heat will cause the air of the urine of a higher temperature to become more rarefied than the air of the urine of a lower temperature, the consequence of which is—that an increased pressure is made upon the walls of the containing air-bubbles, and thus their disruption is more quickly brought about. It is also necessary, for the proper carrying out of this comparison, to take equal quantities of the different specimens of urine, as well as bottles of equal size; because, if it were not so, the difference of pressure upon the external surface of the bubbles would cause an earlier disruption of those in which the capacity of the bottle was greater, or the quantity of urine smaller, than of those in which these conditions were in the opposite direction. It is even further necessary, in order that comparative differences may be correctly estimated, that the different specimens of urine should be shaken through equal times. If such were not the case, it is manifest that, on one

urine, a large head of air-bubbles would be produced; whilst, on another urine, a small head of bubbles would be generated; and as, under equal conditions, the larger quantity would occupy in their subsidence a longer time than would the smaller quantity, a palpable error as to duration would necessarily arise. The best method of determining this point probably is—to put two ounces of each specimen of urine into separate bottles, each of which is capable of holding six ounces of fluid—to shake each bottle a sufficient length of time to cause a head of bubbles which shall occupy the whole of the remaining space of such bottle—and afterwards to note, in each instance, the time occupied in the complete subsidence of the bubbles.

URINARY SEDIMENTS IN DISEASE.

It has already been shown how disease modifies the urine in its quantity, density, colour, and aërability; how great is the knowledge which may be acquired by watching these changes; and what special significance that knowledge has, in reference to prognosis and treatment. But, however important such knowledge may be, it is not of more consequence in urinary pathology than the study of the sediments which occur in the urine during the different diseases which afflict the human body. To none of these sediments does more importance attach than to those which are known as the urates of the alkalies. To these and to uric acid separately considered, in relation to disease, I confine myself on the present occasion. Of these sediments there are two sources only as connected with the body. The one is—the food taken into the body—the other, the tissues of the body itself, or that portion of blood thrown out under disease, which would, in the ordinary course of nutrition, have been converted into the bodily structures. When, then, these deposits occur in the urine, it is important to know from which of these two sources they arise, and what is their special importance in the particular case under examination. Now, with respect to the food, as a source of uric acid and its combinations as alkaline urates in the urine, it is from the nitrogenized portion that these are derived. This portion of the food may either be in excess of the natural requirements of the system, or the digestive organs may be unequal to its perfect digestion. In the former instance, the surplus aliment undergoes a metamorphosis, by which its protein compounds are broken up, and afterwards re-

arranged and combined in the form of urea, which thus appears in excess in the urine, to which it gives a high specific gravity. This condition generally occurs where the digestive organs are in a healthy state and the nitrogenised food exceeds the demands of the body. Such a urine remains clear for some time after becoming cool, and does not generally deposit a sediment until from two to five or six days after its emission. This deposit presents both the chemical constitution and microscopic character of the urate of ammonia. Whence, then, has this urate of ammonia its origin? Let me appeal to facts for an answer. An ounce of fresh urine, directly after its emission from the bladder; was submitted to examination, and was found to contain 12·48 grains of urea. The sample of urine, from which this ounce was taken, was set aside in a well corked bottle. After standing five days it deposited a sediment of urate of ammonia, and gave, as in the first instance, an acid reaction to test-paper. Another ounce of this urine was now submitted to examination, and its quantity of urea was found to be 10·08 grains, thus showing a loss of 2·40 grains of urea during the five days in question. Again, it was found that, co-incident with this reduction of urea, there was an increase in the quantity of uric acid. Thus in the same sample of urine the quantity of uric acid was, in the first instance, found to be ·30 of a grain per ounce, which was increased to ·50 of a grain per ounce by the end of the fifth day, when the urine had deposited a sediment of urate of ammonia. If we appeal to the urine of disease we still find a confirmation of these facts. Thus, in a case of acute peritonitis, a specimen of urine, examined immediately after its emission from the bladder, contained 16·32 grains of urea per ounce; whilst the same specimen, after standing two days, during which time it deposited a rather copious sediment of the urates, yielded only 11·52 grains of urea per ounce. Co-incident with this reduction in the quantity of urea the uric acid increased from 1·10 grains per ounce in the first examination, to 1·85 grains per ounce in the second examination, which was conducted at the expiration of the two days in question. To what explanation do these facts point? Evidently to the following—that the urea contained in both healthy and diseased urine is, from the time of the emission of the urine from the bladder until it passes into putrefactive decomposition, convertible, and is in part converted, into uric acid as one of the derivatives of the transformation which the urea undergoes. It would thus appear that before actual decomposition converts the urea into

carbonate of ammonia, the molecular forces which maintain the unity and integrity of urea give way—that a part of the urea is thus resolved into its ultimate elements—and that the re-arrangement of these elements results in the formation of uric acid and ammonia, with the liberation of oxygen. Hence, as is shown by the following formula, five atoms of urea are convertible into one atom of uric acid, six atoms of ammonia, and six atoms of oxygen.

	C	H	N	O
One atom of uric acid	10+	2+	4+	4
Six atoms of ammonia . . .		18+	6	
Six atoms of oxygen				6
=Five atoms of urea . . .	10+	20+	10+	10

During the occurrence of these changes the mucus, always present to a slight extent in healthy urine, may likewise undergo transformation, by which it is converted into lactic and acetic acids, which displace the uric acid from its combination with the fixed alkaline bases, and thus permit it to unite with a part of the ammonia formed from the urea, and to appear as a sediment in the urine. The practical inference to be drawn from these views teaches, that, in the absence of disease, a urine of high specific gravity (1·026-30), perfectly clear at the natural temperature of the atmosphere, and remaining so for several days after emission, abounds in urea—that the latter is due to an excess of nitrogenized food—and that the digestive functions are healthy.

Where the digestive organs are unequal to the perfect digestion of nitrogenized food, the latter is not so generally converted into urea as in the former instance; but it, on the contrary, is broken up, and its elements are re-arranged as uric acid and ammonia, which, as urate of ammonia, subside in the urine on its becoming cool after emission. Here again, the practical inference is that, in the different forms of dyspepsia, in which urate of ammonia appears as a sediment in the urine, this sediment is derived directly from the nitrogenized food—that such food does not necessarily exist in excess—but that its conversion into urate of ammonia is owing to defective digestion and assimilation.

When uric acid and the alkaline bases occur in the urine as the product of the disintegration of the tissues of the body, it is the result of either excessive muscular exertion or disease. In all acute diseases, attended by increased vascular action and by

general febrile movement, there are periods in which the deposit of urates invariably occurs in the urine. In fevers, in local inflammations, in acute gout and rheumatism, and in pulmonary consumption, this deposit is the product of such diseases, and it has in consequence a significance which should be properly understood. In the eruptive fevers of scarlatina, rubeola, and variola, it does not, as a rule, appear in the urine until the eruption has reached its height and is beginning to decline. In typhoid and typhus fever there is reason to believe, that its appearance in the urine is co-incident with the fading of the petechiæ and maculæ characteristic of these fevers; and, in the case of typhoid or enteric fever, with the commencement of the absorption of the morbid deposit found in Peyer's glands; in erysipelas, with the cessation of exudation and its commencing metamorphosis; in local inflammations, with the absorption and removal of the inflammatory products from the affected organs; in acute gout and rheumatism, with the removal of morbid products from the affected joints; and in pulmonary consumption, with changes which are constantly occurring in and around the tuberculous deposit. It will thus be seen, that the appearance of a urate deposit in the urine is generally indicative of a tendency to recover; or it at least shows, that nature is making a strenuous effort to rid herself of the incubus of disease. The former part of this statement is true in its application to fevers, inflammations, and acute gout and rheumatism; whilst the latter part is applicable, and that only in part, to pulmonary consumption. Whilst, then, the deposit of urates must be accepted as a favourable sign in the former diseases, it is often, in pulmonary consumption, but the measure of the disintegration of tissue produced by disease. In the one it constitutes a favourable omen; in the other, the too frequent evidence of wasting life and impending decay.

In all organic diseases in which the general health is being undermined, urate deposit in the urine has the same unfavourable significance as in pulmonary consumption—it denotes the waste of tissue rather than the removal of adventitious products. Under certain conditions, however, it may nevertheless, even in organic diseases, become the measure of improvement. This is the case when an intercurrent inflammation has arisen, and been subdued, and when, in consequence, the metamorphosed exudation appears in the urine in the character of the urates. Thus far, but thus far only, have the urates a favourable significance in organic disease.

They indicate the cessation of the intercurrent inflammation and of the removal of its products; but they continue after these occurrences have taken place, and they then again become an exponent of the destructive action of the original disease. Their duration in the urine is capricious in all diseases except those of an acute or inflammatory type. In acute inflammations they continue in the urine, all things being equal, until the products of the inflammation have been removed from the tissues of the organ attacked. Difference of organ makes no difference in their constitution. They are the same in meningitis, cerebritis, bronchitis, pneumonia, hepatitis, peritonitis, and all other inflammations. Hence, the urates are essentially the urinary sign of the metamorphosed exudation of all inflammations. Their chemical constitution is not affected by the particular organ which suffers; but their relative continuance is modified or influenced by the particular organ or structure which is affected. Thus they have a longer duration in the removal of the products of inflammation from closed sacs, as the pleura and peritoneum, than in the removal of inflammatory products from structures having openings on the surface of the body, as the mucous membranes. Hence, urate deposits occur in the urine for a longer period during the absorption and removal of an exudation from the pleural cavity than from the bronchial membrane—from the cavity of the peritoneum than from the mucous membrane of the bowels. In both instances the quantity of urates which is cast off may be the same within a given time; but the time itself is longer in the one than in the other—in the case of pleuritis or peritonitis than in that of bronchitis or muco-enteritis. The reason of this difference appears to be—that all the exudation of pleuritis or peritonitis must, in consequence of the pleura and peritoneum having no *direct** outlet or communication with the surface of the body, be absorbed into the blood, and be by it carried in part to the kidneys in its removal from the body; whereas a part of the exudation of bronchitis and of muco-enteritis is at once expelled by the affected membranes themselves, and thence conveyed direct from the system, the effect of which is, to lessen materially the quantity of exudation to be absorbed, and consequently, to render the time occupied in its

* The fact that the peritoneum communicates with the surface of the body by the Fallopian tubes, uterus, and vagina, does not here affect the argument which regards it as a closed sac, so far as it influences the removal of morbid products from its cavity.

absorption of shorter duration than that of pleuritis or peritonitis. As the absorbed product of inflammation undergoes the necessary transformation, and is for the most part removed from the blood by the action of the kidneys, it follows, that the duration of the deposit of urates in the urine will be equal to the period of the absorption of the exudation; and, as this is shorter in the case of bronchitis or muco-enteritis than in that of pleuritis or peritonitis, in consequence of the direct expulsion of a part of the exudation in the former and not in the latter, so also the continuance of the deposit of urates in the urine is longer in the latter than in the former of these inflammations. For similar reasons, the breaking up and removal of the exudations of inflammations of the parenchyma of organs produce a longer period of deposit in the urine than the metamorphosis and expulsion from the body of the exudation of bronchitis or muco-enteritis. In acute diseases of the skin, as in eczema, herpes, ecthyma, and scabies, where the eruption is sufficiently extensive or sufficiently irritable, to arrest in part the natural action of the skin, and to excite the mobility of the nervous system, as well as to disturb more or less the balance of the circulation, the urates are generally deposited in the urine. When, however, skin diseases have existed for some time—when they have ceased to disturb, to any great extent, the quietude of the nervous system—and when the body has become habituated to them, so that the partial arrest of the function of the skin is compensated by increased activity of some other organ or organs—urate deposits are not of constant occurrence in the urine. Under such circumstances they appear on any aggravation of the cutaneous disease, either by diet, by cold, by bodily exertion, or by mental worry; but no sooner have these causes subsided and the increment of disease has passed away, than the urates cease to appear in the urine, and this fluid returns to the character it manifested under the stationary condition of the disease. Hence, in acute diseases of the skin, the appearance of urates in the urine has a somewhat different significance from that which they express when present in the urine of local inflammations. They do not express in the former, as they do in the latter, the cessation of exudation, its metamorphosis, and its removal from the body; but they rather show, in addition to the metamorphosis of the products of disease, disintegration of the bodily tissues caused by constant excitement of the nervous system arising out of the irritation on the surface of the body. In this view the urate deposits of the urine in acute

diseases of the skin are a measure of exudation-waste and tissue-disintegration; and, in the light of the latter, of the nervous irritation which has received its mental expression in pain, or in those uneasy sensations of heat, smarting, tingling, burning, stinging, and itching, which are the ordinary consequences of such affections of the skin.

As the presence of the urates in the urine of acute diseases has a particular significance which has already been indicated, so their absence or partial absence from it in other instances, is a matter of considerable importance in the prognostics of disease. If, for instance, the urine of variola, rubeola, or scarlatina, should not, after the acme of these diseases has been attained and when the eruption begins to decline, deposit a sediment of urates, a sequela is most certainly at hand. If, in acute gout or rheumatism, the improvement of a joint is suddenly followed by the disappearance of urate deposit from the urine, another joint is about to be affected. If, in typhoid fever, the urine remains clear and without a deposit of the urates at the time when the characteristic petechiæ or spots usually fade and disappear, it may be confidently predicted, that the fever is about to be prolonged, and that considerable danger will arise to the patient. In like manner if, in the outset of albuminuria supervening on scarlatina, the urine is free from urate deposits, it shows a general affection of both kidneys; because, if one only of these organs were unaffected, or if the two were only partially affected, the unaffected portions would eliminate the products of the previous scarlatina in the form of the urates, which would appear as a sediment in the urine. On the other hand, when, in scarlatinic albuminuria, the urates appear as a deposit in the urine from which they have hitherto been absent, they are a sign of the improvement which the kidneys are undergoing, and of the tendency of the disease to recover; because they show that the excretory action of the kidneys, which had hitherto been suppressed by the presence of disease, is in part restored, and that the disease itself of the kidneys has, at least to some extent, abated. In diabetes mellitus the occurrence of urate deposits in the urine may have a similar significance. In the outset of this disease, and for some time after its occurrence, it is not uncommon for urate deposits, uric acid in crystals, and phosphate mixed with oxalate of lime—the two former existing separately or together, and alternating with the lime sediments—to occur in the urine; but when this disease has become chronic, such deposits are, as a rule, absent

from the urine. Now if, under this last mentioned condition, the urates should, either from the effect of treatment or without any assignable cause, be deposited in the urine, they show that the natural action of the kidneys has at least been increased, and they thus become a favourable increment in the future prognosis of the disease. With the presence of these deposits it will invariably be found, that the quantity of sugar has diminished, and that the natural urinary solids have increased in quantity. It will not unfrequently happen, that this increase of the natural solids of the urine is also attended by an increased secretion of urine, which may even reach twice the quantity which the patient had for months or years been voiding. But this increase does not continue. In a short time it falls to the previous quantity; then below it; and afterwards to the quantity of the healthy standard. In this declension there are a reduction of the quantity of sugar and an increase of the natural solids in such a ratio, that a density of 1·020 is reached with only a trace of sugar existing in the urine, where before the specific gravity was 1·033, whilst the natural solids of the urine amounted to the fraction of a grain only in the ounce of fluid, thus showing the urine to be little else than a mere solution of sugar in water. In such a case, of eleven years' standing, I was consulted but a short time ago. The treatment pursued had the effect of first increasing the quantity of urine very considerably, then of reducing the relative quantity of sugar and of increasing the relative quantity of the natural solids of the urine; and lastly, of reducing the quantity of urine almost to its natural standard, of diminishing to a great extent the quantity of sugar, and of increasing, in almost proportionate ratio, the natural solid constituents of the urine. These facts, properly interpreted, show—that there is a conservative power in the system, which, when properly assisted, tends to the complete removal of disease and to the perfect re-establishment of the healthy functions of the body—that the natural excretory action of the kidneys may be almost entirely suspended for years without the integrity of the structure of the kidneys being at all impaired—and that, on the removal of the disease, this action may be resumed and discharged with all the original efficiency of health. They further lead us to the conclusion, which has already received the confirmation of almost a generation of physicians, that diabetes mellitus, although it manifests its outward expression through the kidneys, is in no way a disease of the kidneys themselves—

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and that, however long a case of diabetes may have existed, whatever may be the quantity of sugar which is present in the urine, and however fractional may be the quantity to which the natural solids of the urine have been reduced by the disease, hope of recovery under judicious treatment may be entertained.

In further considering the question of urate deposits in relation to disease, it may be important to know what practical inference, if any, can be drawn from the quantity and colour of the urates which are produced in the urine by disease. Now, as every inflammatory exudation must, in its removal from an organ which has no direct communication with any outlet of the body, be absorbed into the blood, and must undergo those transformations which enable it to escape through the excretory organs of the body, and as the kidneys are the great channels by which this office is performed, it is manifest that the urine will, in some way, indicate to a very great extent the measure of these transformations. This it does by the quantity of urates it lets fall after its emission from the bladder. If, then, in a case of local inflammation, the urine lets fall, on the abatement of the more urgent symptoms, a sediment of the urates, this occurrence may be accepted as a sure sign that the morbid action has ceased, at least for the moment, and that the disease tends in the direction of recovery. If the sediment is great, the probability is also great, that the improvement will advance; if small, that its continuance is uncertain, and that the influence of an adverse cause would assuredly excite a renewal of the disease. The quantity of sediment, however, must be judged according to the extent or severity of the inflammation and the particular structure or organ affected. In inflammation of all the larger organs, as the lungs, the liver, and the brain, as well as in inflammation of the pleura or peritoneum, we should expect that the cessation of active disease would be followed by a considerable urate deposit in the urine. The extent, however, of inflammation of these organs does not so much determine the quantity as the continuance of the urates. Thus, in single pneumonia, the metamorphosis of the exudation may at first produce quite as great a deposit of the urates as in double pneumonia, in which the extent of structures invaded by disease is twice that of the former; but the continuance of such deposit will be longer in double pneumonia than where one lung only is affected. Again, the deposit of urates may for a time be quite as great in the breaking up of an exudation in inflammation of one tissue of an organ as in that of inflam-

mation of all the tissues of which the organ is composed; but the duration of the deposit will be shorter in the former than in the latter. Hence, the urate deposit occurring on the removal of the exudation of a bronchitis will be of shorter continuance than that which accompanies the removal of the exudation of a pleuro-broncho-pneumonia; and so also with respect to other organs. In these, as in all instances of simple acute inflammation, the quantity of urate deposit in the urine becomes a measure of the progress of improvement: but in chronic inflammations, in pulmonary consumption, and in organic diseases which have already begun to undermine the general health, it has a somewhat different significance. In chronic inflammation there is an almost continued exudation taking place, with, however, occasional remissions or partial abatements of disease. During these remissions absorption to a certain extent of the exudation and its transformation occur, the products of which appear as urates in the urine. Thus far the urate deposits express an improvement for that particular time; but a fresh accession of inflammation occurs, the urates as a deposit disappear from the urine, and the improvement which their presence indicated, is again lost in the recurrent aggravation of disease.

In pulmonary consumption there are similar remissions and similar aggravations of the disease, with similar results and similar inferences. Tubercle is deposited from the blood; its advent is marked for the time by a certain excitement of the system and by local signs; the deposit ceases; urates appear in the urine, and the patient is better. Here, the deposit of urates is the measure of a temporary improvement in the removal of a certain portion of the exudation from the lungs; but, by-and-bye, another crop of tubercles is deposited in the pulmonary tissue; another excitement of the system occurs; again tubercle ceases to be deposited; again do urates appear in the urine; and again is the patient improved in his condition. Here the urates still indicate that the conservative power of the system is attempting the limitation and removal of the disease. At length the deposit of tubercle has become too great for the vitality of the pulmonary tissue to be maintained; the latter gives way; caverns are produced; low, continued inflammation surrounds them; softening of tubercle and disintegration of pulmonary tissue continue to progress; the products are partly expectorated, partly absorbed into the blood; urates occur in considerable quantity in the urine, and continue with scarcely a remission to the end. Here the presence of the urates is signi-

ficant of exudation-change and tissue-waste—of the progress of the disease to a fatal termination.

In that form of pulmonary consumption commonly known as "galloping consumption," the disease sets in with certain well marked local signs and general febrile disturbance; these never entirely remit; deposit rapidly takes place in the lungs; it and the tissue of the lungs as rapidly break down; urates appear from the first in the urine, and continue to the issue of the case in death. Here the deposit of urates is, from first to last, an expression of the progress of the disease; whilst their quantity is a measure of the rapidity with which it advances.

In organic diseases which have begun to produce their effects upon the general system, the urates are deposited in variable quantities in the urine. They may take their origin from the diseased organ itself, from the tissues of the body, and from the nitrogenised food. Change is going on in the tissues of the diseased organ itself; metamorphosis of muscular fibre is favoured by imperfect nutrition, and by the deterioration by disease of the vital force by which its atoms are held together; and the nitrogenised food is, by the weakening of the function of digestion, neither properly digested nor properly assimilated to the structures of the body. These conditions result in the formation of urates as the products of the transformations thus induced, and as such they seek their natural outlet through the kidneys, and appear as deposits in the urine. Their quantity and their constancy thus become an indication of the progress which marks their onward course to the grave.

From the colour of the urate deposits, as they occur in the urine, some inference may occasionally be derived as to their origin or the particular organ at fault. Their general colour varies from a dirty drab to a deep fawn or red brown. This is true of the urate deposits of fevers, inflammations, and functional disturbances of the digestive organs. In the outset of skin diseases involving a great portion of the surface of the body, as in eczema, psoriasis, lepra, scabies, rupia, and other affections, these deposits are sometimes overlaid by a pink, fleshy-looking layer, which consists of the urates stained with purpurine. Such is particularly the case when muscular rheumatism is associated with the diseases on which these urates depend. In acute articular rheumatism, in organic diseases of the liver, and in diseases involving the heart or respiratory organs, these deposits are not only stained with purpurine, but they

are often so intimately mixed with it, and it exists in such large proportion, as to give to the urine when shaken a deep lake red colour. When, then, urine of this colour is shown to the attendant physician, let him look for the cause to acute articular rheumatism, to diseases of the liver, to chronic affections of the lungs, and to diseases of the heart.

In the opposite extreme we find urate deposits in the urine of a white colour. They are more frequent in young children than in adults; and, in the latter, they occur more frequently in those whose nervous system is particularly sensitive and impressible to slight causes than in those whose strength and vigour bespeak a more robust constitution. They are essentially a non-inflammatory product, in which light they stand in marked contrast with the urate deposits already described. They have, however, an important significance in the element of diagnosis and in the use of remedies. They express the presence of mere nervous irritation rather than the existence of inflammatory disease. In this light they claim a position between the coloured urate deposits on the one hand and the phosphatic deposits of lime on the other—they neither express the inflammation of the former, nor yet the nervous depression of the latter. They nevertheless denote a condition of the system, which appropriate causes might push into inflammation on the one hand, or into phosphuria on the other. We are thus prepared to find them in the urine of children who are suffering from teething, from worms in the bowels, from remittent fever, and who are constitutionally irritable in their temper and disposition. In the adult several of these causes may operate in their production; but here they are not unfrequently produced, when produced at all, in the course of other diseases which involve considerable disturbance of the nervous system.

It has been shown that uric acid in combination with the alkalies, and especially with ammonia as one of the products of the metamorphosis of an exudation, constitutes the essentially inflammatory deposit of the urine. Uric acid, however, also occurs as a crystallised deposit in the urine. It is, therefore, interesting to know what significance its presence in this form bears to disease. On the first blush of the question it would seem natural to suppose that, as uric acid in combination with the alkalies plays so important a part in all inflammations, it has itself, separately considered, a close relationship with inflammatory disease. Experience does not justify this inference. It is true that uric acid, in an

uncombined form, occasionally occurs in the urine of inflammatory disease towards its close; but this is so seldom the case that its presence in the urine, under such circumstances, may be regarded rather as an accidental occurrence than as a necessary condition of the disease. Hence, it may be safely affirmed, that the presence of uric acid in a crystalline form in the urine is significant of other than inflammatory disease. Now, the diseases with which it is more particularly associated are—muscular rheumatism and disorders of the digestive organs. In its association with rheumatism it takes its origin in suppressed secretion of the skin. A part of the body is exposed to a draught of air or cold wind; it shortly afterwards feels stiff; the patient experiences a sensation of chill, and in a few hours voids urine which, on cooling, deposits crystals of uric acid. Here, the suppressed secretion of the skin and the consequent throwing back upon the blood, if not of an acid, at least of a nitrogenised material convertible into uric acid, rouse the conservative action of the kidneys, by which uric acid is separated from the blood, and passed off in the urine, from which it is deposited in its well-known crystalline forms. Rheumatism thus affecting the system is not of an inflammatory character; there are no swellings of the joints—no exudation—no redness of the skin—no tenderness on manipulating the joints—no thirst—none of the symptoms of inflammatory fever. It is but the expression of functional disturbance of the skin, which is sufficient to destroy for a time the balance and harmony of action of the different organs, and to excite discomfort to an indefinite degree; but which falls short of producing local inflammation. Where local inflammation exists, as in acute articular rheumatism, there is a necessarily consequent exudation, which, in the metamorphosis it undergoes in its removal from the diseased joint or structure, is partly converted into ammonia, with which the uric acid combines, and is thereby prevented from assuming a crystalline form in the urine. In the muscular rheumatism just mentioned there is no such local exudation—no breaking up of an inflammatory product—no consequent formation of ammonia—no such base to seize the uric acid; the latter is therefore deposited alone. But uric acid in crystals is not always deposited in the urine of muscular rheumatism excited by suppressed action of the skin. It as often appears in that secretion in combination with ammonia as a separate deposit; and when it does so, it simply shows that the ammonia was derived from the transformation of the nitrogenised portion of the suppressed pers-

piration, and not from inflammatory exudation. The necessary conclusions to which these facts lead us are—that uric acid in crystals is commonly deposited in the urine of muscular rheumatism; whilst its presence as such in the urine of acute articular rheumatism is seldom witnessed—and that, while urate of ammonia not unfrequently occurs as a deposit in the urine of muscular rheumatism, it is the essential salt of the deposits which occur in the urine of the acute articular form of this disease.

In diseases of the heart uric acid deposits in the urine are not of unfrequent occurrence; but knowing, as we do, that most of the affections of the heart are dependent on rheumatism as their cause, it seems more consonant with true pathology, as to the genesis of uric acid in disease, to regard the deposits of this acid in the urine as connected more with the rheumatic diathesis of such patients than with the mere heart disease, simply considered as such. In this, as in every other organ, uric acid alone is not the deposit which occurs in the acute inflammatory affections of the heart. It is in the chronic affections of this organ that it assumes a free, crystalline form in the urine; whilst urate of ammonia, as a deposit in this secretion, is the common expression of acute disease.

In all diseases, functional or organic, of the stomach, in which an excess of acid is secreted by that organ, deposits of uric acid are apt to occur in the urine. In irritable dyspepsia, in pyrosis, and in the early stages of organic disease of the stomach, this deposit is of frequent occurrence. The stomach, in such cases, secretes an excess of acid; this passes into the blood; it finds its way to the kidneys, is eliminated, and passed off in the urine, in which it displaces the uric acid from its combinations, and causes it to be deposited in a crystalline form. This is certainly one mode by which the uric acid deposit is produced; but it is also probable, that a portion of the free acid generated in the stomach, is digested and broken up into its ultimate elements, and that these elements, in their transit through the system, combine with the elements of the protein compounds of the food in such proportions as to form uric acid, which appears in absolute excess in the urine. Without some such explanation as this it would seem to be impossible to account for the great quantity of uric acid which sometimes appears as a deposit in the urine when little or no animal food has been taken, and when the tissues of the body have not by exercise, or in any other way, been subjected to any undue waste. So great indeed, is the deposit of uric acid in the urine, in many

of such cases, that it has been regarded as evidence of the existence of a peculiar diathesis which has taken the position of an important disease. Whether or not it is entitled to assume this rank in the nosology of diseases, or whether it ought to be regarded as the effect only of a depraved digestion, is a matter of no consequence whatever so long as the treatment is properly directed to the organs which are known to be at fault. Uric acid is not always excreted alone and in such quantity as to appear as the only deposit in the urine. It, on the contrary, is often associated with urate of ammonia and with phosphate and oxalate of lime. These two last mentioned salts give to the urine on cooling a milky appearance, and to the sediment which subsides, a flocculent consistence and a white or dirty-white colour. When uric acid is thus associated with the lime salts, it is an evidence of the existence of nervous irritation and of a certain amount of prostration of the vital powers. It may thus occur in the course of long diseases, in which pain, and especially pain in the neighbourhood of the kidneys, is a frequent element—in injuries to the loins—and at the close of acute diseases. Hence, this association of uric acid, urate of ammonia, and the salts of lime, is frequently to be found in the urine of diabetes mellitus after an aggravation of the lumbar pain which is so commonly felt in this disease—in the urine voided after blows or other injuries received over the loins or bladder—and in the urine of scarlatinic nephritis towards its close. The microscopic examination of the sediment in such cases usually shows the uric acid in diamond or lozenge-shaped crystals and square tables, sometimes of a light fawn colour, at other times colourless—the phosphate of lime in irregular, amorphous particles—and the oxalate of lime in the well-known, beautiful forms of the octahedra of this salt.

Such, then, are the conclusions to which a long series of clinical investigations of the urine has led me. My subject is by no means exhausted; but the present opportunity does not permit me to continue its further consideration. This, however, I hope on a future occasion to resume, and ultimately to place before you in connected whole that of which I now offer you, and through you the whole medical profession, an important part. I am aware that in the attempt to systematize facts which have hitherto in the descriptions of disease presented themselves in a confused and chaotic form—in the drawing of inferences from facts diligently observed and carefully considered—and in enunciating views which, whatever

novelty they may have, are nevertheless to me subjects proved and deductions legitimately borne, I cannot hope to have done my work without error, without imperfections, without faults of some kind. But to whatever extent this error, these imperfections, and these faults may exist, I have confidence, implicit confidence, in the general results at which I have arrived. I therefore commit my present labours to the opinion and judgment of the medical world; I invite its criticism; I court not its favour; because I know, and I rejoice in the fact, that as error must eventually fail in its grasp on the human mind, so truth in the light of knowledge will live, and bear its fruition after many days.

ON HASCHISH.

(AFTER PROFESSOR POLLI OF MILAN.)

By B. W. Richardson, M.D., F.R.S., President.

I take this opportunity of referring to the subject of Haschish in order to bring before the Association some remarkable experiments made by one of our distinguished honorary members, Dr. Polli, of Milan. The experiments were recorded by him in 1860, and at that time I did attempt to make my friend's work known, but with less success than I could desire. Now possibly I may be able to claim a more extended hearing; and if I do not, the importance of the truths to be related is sufficient justification of the present effort.

The *Nepenthes* of Homer, known in this day as *Haschish*, is one of the most singular of narcotic substances. Like to opium, it is fitted either for a pill or a pipe, and, according to taste or circumstances, is used either as a medicine or a luxury. Whatever the form of its preparation, its active principle is always derived from the flowering extremities of that variety of hemp called *Cannabis Indica*. The active substance itself is fixed in a resinous principle, which has been technically called *Cannabina* or *Haschishina*. This resin is not met with in hemps that are indigenous to cold or even to temperate climates.

Haschish, as it comes from the East prepared for use, does not represent the pure resin; it is in cylindrical or candle-shaped pieces, from three to four inches long and the eighth of an inch in diameter. The sticks are pointed, and are of a brown, almost black colour. The material has the characters, when powdered, of a dry extract: it softens readily under the influence of heat, and may be moulded by the finger easily into the form above described. To the sense of smell haschish conveys the idea of hemp or of an impure wax: to the taste it is sharp; it is easily soluble in water, and more soluble in ether; by digestion in ether the impure haschish yields a dark resinous substance, possessing all the properties of cannabina.

The haschish, as we have described it in its impure state, but as it is commonly employed in the East, is either smoked with tobacco, or is taken by the mouth. In Damascus it seems principally to be used in the pipe. It smokes with some difficulty alone, requiring, like opium, the constant application of the torch. When it is eaten, it is mixed with honey or taken in coffee. There is also a fatty and aromatized extract of haschish prepared for those who choose to chew. Again, haschish is smoked in the crude form in which it comes from nature, viz., as the simple flower and seed of the *Cannabis Indica;* nay, it is swallowed also by many without further preparation than that of making an infusion of the seeds and flowers of the plant, as we make tea.

Different varieties of haschish are taken in different doses: of the variety which is bought in the cylindrical form, from seven to eight grains are taken with impunity; of the fatty extract, from thirty to sixty grains may be taken. According to Professor Rech, of Montpellier, thirty grains of the fatty extract are equal in effect to one, or from one to two, grains of the active substance—*Cannabina.* Lastly, haschish is occasionally taken in the form of a spirituous liquid, which is made from the plant *Cannabis Indica* while in its fresh state.

The different modes by which this substance is taken has given rise to a diversity of opinion as to its action on the body, and led Linnæus to speak of it as having "fantastic properties." There cannot, however, be a doubt that whatever the degree of the effect produced by haschish in any of its forms, the symptoms are those of narcotism and intoxication. Nevertheless these symptoms are attended with occurrences so peculiar, psychologically, that the history of them is well worthy of consideration.

Having on some occasions taken the drug with results not very satisfactory, Dr. Polli determined at last to take it in doses verging upon the poisonous; and that no mistake might arise in respect to the effects produced, he associated with himself, as experimentalists, Dr. Vincenzo Rosa and Signor Emilio Sinistri. The specimen of haschish used had been brought by Rosa from Damascus. It was in candle-shaped sticks, as already described in speaking of the varieties.

The three experimentalists met on the 14th of November, 1859. They commenced by each one taking half a gramme (7·7 grains) of the extract: they simply chewed the extract, and washed it down with sips of rum. Half an hour having passed without any per-

ceptible result, a second dose was taken in the same manner, except that a cup of coffee was allowed to follow the administration; and still no effect following, a third dose was taken after a lapse of a few minutes, and a fourth dose of the same size having been mixed with some Hungarian tobacco, not very strong, was smoked from a pipe. They were near the end of their pipes, or rather of the haschish and the tobacco, and still no effect, when one began to jest with some obstinacy of demeanour about certain Frenchified words, and also to rattle his spoon in his coffee-cup in a way that indicated some advance in intoxication. His companions meanwhile sitting on their divan were calm and thoughtful, giving no external signs of an effect, although they afterwards acknowledged that they felt some slight mental confusion. This confusion continued, and the effect of the narcotic was marked well in all three, about one hour and a half after the reception of the first dose.

It is worth while to mention in this place that the temperaments of the three experimentalists were very different. One was of a sanguine, the other of a nervous, the third of a lymphatic temperament. Their modes of life were likewise different. One was accustomed to stimulants, to tobacco, to the taking of a free quantity of food, and indeed to good fare altogether; another was accustomed to stimulants and to tobacco, but he always ate sparingly; the third used tobacco, but rarely took stimulants, and always ate very sparingly. Their occupations were equally different. One was a doctor, another a lawyer, a third a man of letters. The symptoms of inebriation from the haschish once pronounced, developed themselves with great rapidity in them all. Their first sensations were of intense astonishment at the circumstance that they found themselves no longer masters of their own acts, while they still remained lucid witnesses of all acts, however foolish. Here the difference between alcoholic inebriation and inebriation from haschish is strongly marked. They saw themselves committing absurdities of the most grotesque kind; leaping, beating time to nothing, moving their arms as if receiving electrical shocks, writing ridiculous words, and so forth, without any power on their part to prevent such exhibitions, but yet standing, as it were, independently of them, as though they were merely subjects of observation exhibited from other persons than themselves. At the first they had the sensation and appearance of feigning a state of exaltation which they did not feel, and which was even feigned with so much uncertainty and awkwardness that any one who would not be aiding

in it would, for a long time, believe in its unreality. It is, nevertheless, an irresistible propensity.

The sensations by which these effects are attended are very difficult to describe by the experimentalist, and are the more profoundly difficult in proportion as he himself is conscious of them. Nevertheless the sensations are satisfactory and laughable. To feel, says Dr. Polli, one's own identity changed, or, it were better to say, divided ; to feel one part preserving its integrity, while the other plays the fool ; to find one's self strongly disapproving of the acts of a neighbour under the same influence, and while acutely perceiving the folly of his proceedings to be unable to refrain from entering into his whim, is a mental phase full of interest.

The sense of division of identity seems the effect of two successive and alternate states of mind. At one moment the intellect is obscure, and loses itself in forgetfulness of the past ; then it returns clear, and is able to form a judgment for a moment, and to disapprove of any acts it may have before sanctioned, but only to be again involved in that state of of automatic folly which is so peculiar a phenomenon during haschish intoxication. During the intervals of confusion or darkness, the lucid moments possess a power and comprehension truly marvellous : so that in a few seconds the most distinct and accurate picture of a range of life, including as much as forty years, may be recast and surveyde. The alternation from obscurity to lucidity is like the effect of a sea wave ; a lucid wave is followed by a dark overhanging wave, on which the mind is shipwrecked and carried with the sensation of a melancholy floating towards forgetfulness and oblivion, to be roused instantly by the passage over it once more of the wave of life and light. The dark waves chase each other so long as they continue, and the mind, unable to continue its thoughts and acts, but bending under a successive series of impressions, the shortest space of time seems to present the duration of an eternity.

For these peculiar alternations of lucidity and melancholy, which mark the first stages of haschish intoxication, Dr. Polli offers a very curious and interesting interpretation. He thinks that, from the first taking of the drug, small portions of it are absorbed and enter the circulation without interruption. The blood then carries a small wave of the poison to the brain, upon which occurs that state of obscurity which we have described. But the column of blood charged with the poison, passing on through the brain, is succeeded by a column of pure blood, upon which the interval of lucidity is

presented. The extremes of effects are thus the results of extremes of contrast. The lucidity experienced is the same in kind, though infinitely more intense in degree, to that which obtains when one is suddenly roused from sleep to the light of a sunny day.

That seeming extraordinary slowness of time, which struck the observers in so singular a manner, and made them so impatient of delay that they were continually recurring to their watches, and observing, with a kind of awe, how minutes were transformed into great epochs, is explained by Dr. Polli as due to the rapid and varied succession of the numerous ideas which passed through the mind. No more evident proof could be adduced to show how the mind measures time solely by the succession of impressions made upon it; and how a few moments, in a life full of sensation, may be equal in realization to many years of a life addicted to monotony or monotonous labour. With this apparently interminable length of time, under the influence of the haschish, there seemed to occur a kind of forgetfulness, by which an act of the mind, taking place an interval before, or an impression received some time before, were in a manner forgotten; but in a few brief moments they returned, or presented themselves, as it were, for the first time, and in such manner, almost unexplainably, repeated themselves, and reproduced frequently, as new, the impressions they re-inspired.

There was another singular condition excited by the narcotic in our experimentalists—a moral phenomenon: the influence of the drug showed itself in exciting in the observers, so different themselves ordinarily in general character and temperament, a common docility and absence of susceptibility which was most remarkable. Thus one of them gave to another, with whom he was but slightly acquainted, a series of hard blows on the back, saying that he himself felt nothing of the haschish, and asking whether the blows he inflicted were felt. On his part, he who received the blows took them all in good humour, uttering no complaint, and seeming, indeed, insusceptible of complaint. Again, one of them, who sat writing, submitted to receive the infliction of two sharp blows, boxes on the ears, and to have his pen snatched out of his hand, without any expression of pain or even annoyance. Reproaches between themselves for having taken the drug never passed; but each, laughing all the time, tried often, in lucid intervals, to produce sickness. Such was the good humour that prevailed, that each one mutually yielded up his own will and obeyed the other, the whole trio joyfully concurring in all that suggested itself to them, as withdrawing

them from the idea of danger, and fully agreeing in particulars as to the sensations they experienced. In these phenomena, says Dr. Polli, the secret of the magical influence which the Old Man of the Mountain is said to have exerted over his adepts, to whom he drank in haschish, was fully and personally explained to us.

From this general description of the incidents presented in the first stage of narcotism by haschish, we are led next, in the narrative before us, to a personal account of the sensations experienced by the experimenters, in so far as they could recollect the order of the occurrences after their complete recovery. The youngest of the party, whose age was twenty-three years, who was of lymphatic temperament, and who took and retained the largest dose of the drug, and on whom the effects were most profound, but least apparent, expresses his recollections to the following effect:—

Whilst smoking the last portion of the haschish, he was seized with melancholy, from which he could only rouse himself by imitating the movements and follies of the others. Then he had a great inclination to laugh, but kept himself free from the obvious action of the drug by going behind his companions. Suddenly he perceived a change in his intellectual faculties, which appeared less obedient to his will; and feeling he should be worse, he began to register his thoughts of what might happen to him. Scarcely had he begun, than it seemed more important to him to record the follies uttered by one of his companions. He soon felt himself, however, unable to continue; and his hand with difficulty traced unformed characters. Then becoming pre-occupied with a theme which scribblers might think the act of a madman, he with great difficulty wrote a short justification of his conduct in Milanese. He began next to feel a pleasing stupor; his head seemed to dilate, but without strain, gently, gently. He possessed the use of his senses and mind, but every occupation wearied him. He passively assisted in what was occurring around him, and unable to give any account of it, or reason, was able to laugh at all and everything.

After about a quarter of an hour, a weakness of his whole body came on; his legs would not support him, his arms became heavy, and he was seized with a kind of fainting, similar to that which at times follows loss of blood. He was obliged to throw himself on the sofa, his limbs became rigid, he entirely lost his sensations, becoming cataleptic, and remained for a long time in this state. By degrees his senses partially returned, so that he was enabled to understand and retain some directions given to him; but he became

insensible again, and when put to bed, a very hot box placed at his feet, which were very cold, produced no impression. By degrees the insensibility or anæsthesia, which had pervaded his whole body, relaxed in the left half of his body, but remained perfect in the right. His consciousness, which had never entirely left him but for a few brief moments, by degrees returned to its natural state, so that he could recall what had occurred him, and reflect upon his condition. Again anæsthesia extended all over his body, and now was added an automaton-like and rapid movement of the hands, one hand being pressed on the breast, and rubbed actively on the back with the palm of the other hand; his head also ached, and he had a sensation of weakness. The anæsthesia gradually decreased, but the sensibility did not return universally, nor steadily, there being frequent relapses. By turns the right arm, or the leg, or the right half of the face, and then all these parts together, would seem petrified, so that he could not move them, and would then relax. As time went on, these phenomena were more frequently repeated in the head and face, the change being quick enough to give great pain; when suddenly the mass of his brain, all except a small portion, seemed changed to marble, and appeared to him to possess all the properties of such a substitution; his right eye for a long time retained the sensation of marbly hardness. These symptoms, now going, now returning, lasted more than thirty-six hours. The mind, meanwhile, had not remained idle, but during moments of returned consciousness assisted as a spectator: ideas succeeded each other with such rapidity, that they made a short space of time seem very long. These ideas, although more often scattered, had at times an intimate and long connection; thus every person who had ever assisted him he seemed to see for years and years, performing all those long and varied series of acts which might in reality have been performed during such a period, so that he felt convinced that all those years had really passed. He also had a sort of hallucination, in which he seemed transported to a place whimsically made of brass; this, he thought, was the vestibule of Mahomet's paradise, and that he was denied entrance to it. On going out, he found himself launched into space, and compelled to describe very rapidly a vast orbit, in a gloomy, painfully-breathing, oppressive circle. This painful sensation lasted a long time, and was among the most disagreeable of the experiment.

Dr. Polli, much more brief than his friends in his description of his sensations, states that, generally speaking, he was subjected to

similar effects. He recollects that he was a prey to extreme loquacity and mobility of ideas, that he was continually pre-occupied with solicitous impressions as to the fate of his companions, for whom he feared the dose of haschish had been excessive, and might even prove poisonous. After he had taken the drug about six hours he was seized with a sort of gesticulatory convulsion in the arms and legs, and by degrees his symptoms assumed those which characterize hydrophobia. He was possessed with outbreaks of fear at the sight of bright objects, at the sensation of every sharp little breath of air, or the approach of any one; but these exhibitions were momentary only, and he then paid no attention to what had been previously exciting influences. He asked for water, and seized the cup with a trembling and convulsive hand, but carried it to his lips only to thrust it away without drinking, being unable, even with the greatest effort, to swallow a single draught. Upon this there succeeded a feeling of uneasiness as though from dryness of the throat, or rather a sensation that the tongue and throat were covered with a dry soft body. Finally, he recalls an urgent desire to be held, to be guided, and to be taken care of altogether, under the involuntary feeling that, if such protection were not bestowed, he should get out of bed (in which he was by this time laid) to commit some foolish act. Dr. Polli was also subjected to a sensation of pressure at the back of the head, before the occurrence of convulsive movements, which changed into an unpleasant feeling of heat, then of cold, in consequence of which his hands were carried automatically to that spot, and were held there, as though there were a difficulty in detaching them. There was also a sensation of cramp in the calves of the legs, which rendered the movement of the legs impossible, or caused them to be distended, or to take a sudden jump. In fact, the character of the muscular action in all three observers differed, being gesticulatory in one, partly tetanic in another, and cataleptic in the third.

FURTHER OBSERVATIONS ON HASCHISH IN MEDICINE.

By Professor Giovanni Polli, M.D., Milan.

(*Translated by Leonard W. Sedgwick, M.D., Hon. Sec.*)

HASCHISH IN MELANCHOLIA.

The exhilarating action of haschish, the lively turn it gives to the ideas, the feeling of happiness and of self-satisfaction which its use produces, suggested to me a trial of it in melancholia.

A lady aged thirty-three years, robust, a widow with four children, at the end of September 1862, became sad and morose, sleepless and without appetite. Purgatives, blood-letting, and at a later period quinine, produced no relief. Her strength failed from the anorexia and the constant dyspepsia, her mind was continually tormented by the apprehension of the imminent ruin of her family, and although they were moderately well off she desired to die, that starvation of the rest might be postponed; and she in consequence abstained from all nourishment. Her breath became offensive, her teeth dry and covered with sordes; she was so feeble that she was unable to rise from her bed, and emaciation quickly increased. She could not be consoled; she was always in tears; her nights passed without sleep; and the desire to destroy herself was ever present. She could not be left alone. This condition had lasted fifty days. No repose had been obtained either by opium, by wine, by food which she had been compelled to take, or by tepid baths. Revulsives to the extremities, sinapisms, and the cold douche down the back were used without any good effect. It was then that I thought of Indian hemp.

I began the administration of the remedy in the form of the sugary and oily sweetmeat called *Dawamesk* by the Egyptians. Of this I gave ten grammes (154 grains) in a strong infusion of coffee; the dose was equivalent to one gramme (15·4 grs.), or a little less, of the black-brown extract which I used in the experiments on myself. I persuaded my patient to take the dose during the dinner of her family. It produced at first a sensation of weight at the

stomach, and a species of interrupted drowsiness. She talked during the early part of the meal, but afterwards lapsed into a tranquil taciturnity. The night following, though sleepless, was calm.

Two days after, the same dose was repeated at the same time; and now the patient began to taste food. After dinner the tranquil taciturnity came on. She saw, she observed, she paid attention, but she could not open her mouth to speak. Nevertheless she was not more sad, but calm, and sometimes smiling. She seemed to dream with open eyes, and the time appeared to her very long. She slept a little during the night, and awoke in the morning feeling less languid than usual and with some desire for food.

The day afterwards, the fourth of the treatment, five grammes (77 grs.) were administered in the same manner as before. The digestion was good, and she began to speak without trouble or sadness. She could see her children without crying, and with a kind expression. She talked still of anticipated ills, but she could be brought to better thoughts by reasoning with her.

The two following days the same dose of the Indian hemp was given in the same manner, with amelioration of the symptoms. The medicine was then withheld for a day that aloes might be given to relieve constipation. Then two days more of the hemp, and one of aloes again.

Thus in ten days the patient had taken fifty grammes (771·5 grs.) of *Dawamesk*, equal to five grammes (77 grs.) of brown extract of Indian hemp, with a steady and progressive amelioration of all the phenomena; the nights became tranquil, the intelligence just, the affections natural. There only remained for a few days a little loquacity, some inclination to laugh unnecessarily, and a slight muscular feebleness.

Some months afterwards this lady was perfectly well, lively, and in flourishing health. The cure was permanent.

HASCHISH IN HYDROPHOBIA.

Among the effects resulting from the administration of a large dose of haschish, I have been struck by the singular impressionability to slight currents of air, and to the glittering of bright bodies; and especially have I noticed the sensation of a species of suffocation, a sensation which seemed to me to be analogous to that which would be produced by a layer of cotton wool adhering

to the pharynx. This singular alteration of sensibility inspired me with the idea of making a trial of haschish in hydrophobia—an attempt to treat an incurable and mysterious malady by a no less mysterious remedy.

A man, aged thirty-eight years, was admitted into the Grand Hospital of Milan on May 12, 1860, who had been bitten by a mad dog a month previously, and who was already suffering with all the symptoms of hydrophobia. I determined to treat him solely by haschish. I employed the brown-black extract which I had used in the experiments on myself. He was made to swallow half a gramme (7·7 grains) of it every four hours for five times, so that he took altogether two and a half grammes (38·5 grains) of this extract of Indian hemp. It was cut into small pieces and placed on the tongue; the swallowing of the drug was assisted sometimes by a little sugar, sometimes by a little milk, and sometimes by a little tincture of aniseed. The action of the haschish taken by the mouth was aided by enemata of an aqueous infusion of coffee, eighty grammes (3·8 ounces) of powdered coffee to a litre (1·76 pint) of water, which was administered by degrees. In a period of little less than twenty-four hours this hydrophobic patient had taken two and a half grammes of extract of Indian hemp by the mouth, and a litre of infusion of coffee by the rectum. This treatment did not dispel the characteristic phenomenon of horror at the swallowing of water or of any fluid; neither was there freedom of alvine dejections or of emission of urine. The patient remained very constipated, and the urine had to be removed by the catheter. He succumbed fifty-six hours after his admission into the hospital; but the evident effect of the haschish taken was an amiable good humour, a species of gaiety, and of reliance on medical aid; and the cessation of the delirium, the terror, and the convulsive madness which seizes on all hydrophobic persons to such an extent that it is necessary to use physical constraint. Bright light also, the reflection of shining bodies, currents of air or of the breath, which are insupportable by ordinary hydrophobics, in him produced no disagreeable impression. The patient was left at liberty, that is, without any bonds, lying free on his bed; and this tranquil state lasted forty-eight hours after the commencement of the treatment by haschish, and was only interrupted by some convulsion or grimace, which slowly became more frequent, and by the menace of suffocation from the foam at the mouth as the mortal symptoms increased until his death.

The haschish, without curing the hydrophobia, removed the

greatest part of its horrible symptomatology; a result accomplished neither by opium, nor by morphine, nor by daturine. Haschish, then, is the best palliative or sedative in hydrophobia. It changes a raving, unmanageable, suspicious, aggressive maniac, who bites and who curses you, into a poor invalid, content and tranquil, who blesses you.

AN ANTIDOTE AGAINST HASCHISH.

Now that haschish may be employed as an exhilarating agent, and even as a remedy for melancholia, it is useful to know the substances which are able to increase or to destroy its action.

Experience has proved that infusions of coffee, tea, or cocoa, always exalt the effects of haschish, so that it should be taken or administered in an aqueous infusion of these substances if it is wished to accelerate or to augment its action.

Lemon juice and vinegar, and consequently citric, malic, tartaric, and acetic acids, in aqueous solution more or less dilute, arrest the effects of haschish in persons who have taken it, and in consequence serve as true antidotes.

It will be advantageous, then, in experiments with haschish, and especially in the treatment of certain nervous affections in subjects whose susceptibility to the influence of the drug is unascertained, to know that one has, in the more or less concentrated lemonades of these acids, powerful, and at the same time innocent, moderators of the nervine action of haschish.

I confess that it is not from my own personal experience that I have confidence in this antagonism between the vegetable acids and Indian hemp, but solely from that of the Egyptians who have assured me that it is invariable; and from the testimony of Dr. Castelnuovo, who lived for a long time in Tunis, and who was convinced of the antidotic value against haschish of lemon juice and strong solutions of similar vegetable acids.

NOTES ON THE THERAPEUTIC VALUE OF THE CHLORIDE OF AMMONIUM.

By William Cholmeley, M.D., M.R.C.P. Lond.

The salt now called the chloride of ammonium, but much better known as the hydrochlorate or muriate of ammonia, has long been highly valued in Germany and Russia as an internal medicine, and has been accredited with extensive and very positive remedial powers. Pereira tells us that "in Germany it has a great repute as a powerful alterative and resolvent," and is used in mild inflammatory fevers, in inflammations of the mucous or serous membranes, and in chronic diseases of various kinds; and by Sundelin we are told "it acts as an excitant and irritant to the venous and arterial capillary systems, to the lymphatic vessels and glands, to the skin, to the kidneys, and especially to the mucous membrane; not only increasing secretion, but also improving nutrition and assimilation, and counteracting organic abnormal conditions (as tumours, thickenings, and relaxations) so frequently met with in those structures. It promotes not only mucous secretions, but also cutaneous exhalation, and even menstruation. It extends its stimulating influence to the nervous and fibrous tissues, whose nutrition it improves."*

But in this country it has been very little used, except externally. Pereira observes, "It is so rarely employed internally, in this country, that we have very slight experience either of its physiological or of its therapeutical effects." † And English writers on materia medica and therapeutics since Pereira's time do not tell us much more about it. Dr. Neligan writes, "I have found it useful in some cases of adynamic fever, and in the subacute forms of laryngitis; also in chronic affections of the liver, and in facial

* Sundelin. "Handbuch der Speciellen Heilmittellehre," 1ste bnd., s. 150.

† Pereira, Vol. I., pp. 444-9, 3rd edn. 1849.

neuralgia."* And Dr. Sydney Ringer, in speaking of the chlorides, says, "They all increase considerably the secretion of mucus from the mucous membranes of the stomach and the intestines, and indeed from all the membranes of this class. They may even excite catarrh. This is notably the case with the chloride of ammonium. This salt may often be used with considerable success in chronic catarrhs of the bronchial and the urinary mucous membranes, but especially of the former. The same remedy has been praised in pertussis. It is also said to be frequently successful in removing the pain of facial neuralgia of a rheumatic character; and the same remedy has been employed by some with advantage in headaches due to menorrhagia, amenorrhœa, &c." But he does not speak, I think, as if he had had personal experience of its value. Sir Thomas Watson, in his well-known and most valuable "Lectures on Physic," bears testimony to its value in a form of neuralgia affecting chiefly the lower jaw. He says, "I was instructed by an experienced old apothecary that this face-ache might be almost always and speedily cured by the muriate of ammonia. And I have again and again availed myself of this hint, and been much thanked by my patients for the good I did them with this muriate of ammonia." "It does not *always* succeed," he adds, "but it *often* does."

Isolated notices of its employment in various affections have appeared from time to time in the medical journals; and Stillé gives in his work on therapeutics an account of its action on animals and on man, and of its therapeutical uses, drawn chiefly from German and French sources.† But the only English writer I can refer to for at all a full account of the real and great value of the muriate, drawn from actual experience, is Dr. Anstie. Just a year ago he published a very interesting and able paper in "The Practitioner," on "Muriate of Ammonia as a remedy for some nervous disorders,"‡ and should this paper not be known to any members of the Association, I strongly recommend it to their attention and careful study.

Dr. Anstie observes, "It is surprising that in view of the well-

* Neligan's "Medicines; their Uses and Modes of Administration." 6th edn., p. 460.

† "Therapeutics and Materia Medica." By Alfred Stillé, M.D., &c. Vol. II., p. 940 and following. 1860.

‡ "The Practitioner." Vol. I., pp. 356 to 364. 1868.

known action of liquid ammonia and carbonate of ammonia upon nervous energy, and in view of the fact that the muriate itself, in large doses, produces fatal convulsions, that the latter should not have been more systematically investigated from the side of its effects on the nervous centres and the sympathetic system. For, setting aside at present the far from improbable hypothesis that the mucous and glandular phenomena are but secondary to this nervous action, it is certainly the fact that a much wider field of remedial efficacy is afforded by the employment of the muriate in moderate doses as a neurotic agent." My own estimate of the remedial powers of the salt agrees very closely with that of Dr. Anstie; and as my clinical experience of its value has been very large, and as I believe that the drug is not yet at all generally known, or appreciated as it deserves, I venture to place before the members of the Association, very briefly, the results of my experience of its use, and to state in what affections I have found it most serviceable.

Beginning, some fifteen years ago, with giving it in the cases described by Sir Thomas Watson, I gradually extended the employment of it to other nervous disorders, and to disorders of the circulation, and as my experience of it has widened, my confidence in it as a remedial agent of great power and efficacy has increased, so that for the last ten years there are very few single remedies which I have employed more constantly and with happier results than the chloride of ammonium.

It will of course be asked, how does this salt act in the human body, in what way does it produce its remedial effects? I believe that it acts primarily on the sympathetic nervous system, on the ganglia and the vaso-motor nerves, and that through them it affects the sensitive nerves, the spinal cord, and the brain, as well as the other structures and organs of the body. The first sensible effect of a dose of it is a pleasant feeling of warmth in the epigastric region, and this sensation gradually spreads throughout the trunk and limbs, the extremities become warm, chilliness of the surface disappears, the skin becomes soft and moist, the circulation is equalised, and aches and pains cease. Hoping to be able to give some proof of its effects on the vaso-motor system by means of the sphygmograph, I applied to Dr. Anstie to know if he had tested its action by that instrument, but he is not as yet able to give any positive evidence on the subject. He has, however, been kind enough to write to me, "From sphygmographic researches made by myself on carbonate and acetate of ammonia, I

have reason to believe that the ammonia salts generally are, in small doses raisers of arterial pressure, in large doses depressors of the same, and that their agency is excited through the vaso-motor nervous system."

1.—In some forms of *Neuralgia* of the fifth pair the chloride is of great service, relieving the pain more quickly and certainly than any other remedy with which I am acquainted. The "face-ache" spoken of by Sir Thomas Watson has been said to be "of a rheumatic character," but I am by no means sure that it is so. It occurs most frequently in women beyond twenty years of age, whose strength has been overstrained by rapid child-bearing, prolonged suckling, anxiety, want, or overwork. It begins in the lower jaw on one side, but soon affects the whole side of the face, generally comes on towards evening, though sometimes in the earlier part of the day, and lasts several hours. Usually it occurs in distinct paroxysms, with perfect intermissions, but in some cases the pain only remits. I do not remember having met with it in men. The pain is not darting or stabbing as in pure tic, nor so acute, but is a severe, though "dull," gnawing, aching pain, with throbbing when it has lasted long. Now the chloride of ammonium, in doses of grs. xv. or xx., three times a day, almost always relieves this pain very quickly. It rarely happens that the next paroxysm, after beginning the medicine, is not of markedly lessened severity and duration, or that the attacks do not cease entirely within three or four days. Should the affection be very severe, it will be better to commence with the ʒss. doses recommended by Sir T. Watson. When the pain has been relieved, ferruginous tonics may be given with great advantage, or when there is great debility the salt may be given in combination with bark.

2.—In some cases of more genuine *Tic-Douloureux*, and in *Hemicrania*, the same medicine is invaluable. It really acts, to use a popular expression, "like a charm." As in the following case. Jane K., twenty-three years of age, a housemaid, stout, and robust looking, but of mobile nervous temperament. Is subject, when excited, anxious, or fatigued, to attacks of intense pain in one side of the face. The pain comes on very suddenly in the cheek, and is of a darting, shooting, and throbbing character; the cheek becomes intensely hot, red, and greatly swollen, the eye suffused, and the lids swollen; and the pain gradually and quickly affects the whole side of the face. When the attack is fully estab-

lished, the girl is almost beside herself with pain, crying, sobbing, and wringing her hands, and quite incapable of trying to do anything herself to relieve the suffering. If she takes the chloride in a ʒss. dose, with a few minims of spirits of chloroform, the pain rapidly lessens, and within an hour is comparatively tolerable. At the catamenial periods she suffers from what is more commonly called hemicrania, and this is also rapidly relieved by the same medicine. I wrote a few days ago to enquire after her, and her mistress sent me this report—"She has had no attack of any consequence for some weeks. The medicine has not lost any of its efficacy; when the attack comes on, it soon gives relief, and almost always takes away the pain in an hour; if not, a second dose completes the cure. She generally has some at hand, that she may take it when she has a threatening, but seldom requires it, except at a special period." I quote this as a particularly well-marked case, the general health being excellent, but it would be easy to give *many* other cases in which the like happy effect was obtained.

Migraine or *Hemicrania*, though often seen in those who live in easy circumstances or affluence, are well nourished, and in other respects healthy, chiefly attacks the ill-fed and overworked, and is therefore frequently met with in the out-patients of a London hospital. It is a neuralgia of the fifth pair, belonging especially to an early period of life,—*i.e.* to the stage of growth—but also continuing often to recur throughout life, or in women till the cessation of the catamenia. Any extra excitement, emotion, or fatigue may bring on an attack, or it may in the delicate and overworked occur very frequently without any apparent exciting cause. It frequently ends in violent sickness, or in sleep, or is at least greatly relieved by them; still, though it will thus spontaneously terminate or remit, it causes great misery and inconvenience, and relief during the attacks and help against their recurrence are eagerly demanded. For the latter, every means possible should be taken to improve the nutrition of the nervous system; for the former, any form of ammonia will, as a rule, be of some use, but the muriate is by far the most valuable, acting much the most quickly, most certainly, and most efficaciously. It should be given in doses of grs. xv. or xx., with spirits of chloroform; and between the attacks, in grs. x. doses with ♏xv. of the tincture of the perchloride of iron, or with bark. And I may here say that I generally give the spirits of chloroform with the salt, because it appears to me to act as an

adjuvant, and because it covers its frequently complained of taste more effectually I think than anything else can.

3.—*Nervous Headache* is too frequently attributed to, and treated as, disorder of the stomach, or of that much abused organ the liver, and this, I suppose, because it is so frequently accompanied with nausea and sickness; but it is undoubtedly a neurosis, of the same kind as hemicrania, but affecting the whole of the head instead of one half only, and occurring much more frequently in men than hemicrania does. Any violent emotion or strain of the nervous system may at once excite an attack in those subject to this form of headache, but generally it comes on the day following some unusual excitement, or anxiety, or intellectual exertion. The victim goes to bed well, but wakes in the morning with a feeling of lassitude and malaise, his mouth is clammy and disagreeable, he has lost all appetite, is chilly, shivering frequently, and yawns constantly; soon nausea and pain in the head come on, and pass gradually into violent vomiting, or efforts to vomit, and intensely painful headache. The feeling of chilliness and the shivering continue, and the head and forehead feel cold to the touch, though there is usually a sensation of heat and burning at the nape of the neck and occiput; light and sound are painful, and all movement excites retching or vomiting, the strain of which intensifies cruelly for the time the horrible throbbing and pain in the head. Sleep at last brings relief, and next day the patient is comparatively well. When an attack of headache of this kind is fully established I do not think any medicine is of any real service, but if taken at the commencement of an attack a full dose of the chloride of ammonium will often cut it short, or at least make it much more bearable. It is, however, as a preventative that the salt is here most valuable, or rather is invaluable. If after any of the causes which he knows, from bitter experience, usually excite nervous headache, the sufferer will take, before going to bed, grs. xv. or xx. of the chloride, with chloric ether, he will almost certainly, *experto crede*, escape the next day's punishment. And this is an immense boon, for, besides the severe pain and suffering, the utter prostration and incapacity for work caused by this affection are terrible evils.

4.—The same remedy does excellent service in *Myalgia*. This affection, which one may perhaps call the moan or wail of ill-nourished and fatigued muscles, may attack any who, with perhaps very insufficient food, work long hours, day after day. But it

especially affects those whose work requires long continuance of one position, so as to throw special strain on particular sets of muscles; and therefore the chief sufferers from it, in hospital practice, are seamstresses, copying clerks of weak constitution, and perhaps shoemakers and tailors, and the muscles most affected are those of the chest and back. It is mockery to tell such patients that the aching muscles must have rest, and that they must take better or more food; the relief they seek must come from medicine, and no medicine will give so great and continued relief, in the great majority of cases, as the chloride of ammonium.

5.—I have found the chloride of great use in one form of *Sciatica*. It comes on in persons of gouty diathesis after exposure to cold and damp, or after unusual excitement or fatigue, however caused. There is a constant not very severe pain in the hip, behind the great trochanter, and frequent, exquisitely acute, excruciating pains shoot down the thigh, making the patient start as if from an electric shock; and when the malady has reached its climax, the knee and ancle are often very painful and tender, and the shocks and darts of pain seem to affect almost every nerve in the body. For the gouty element of the disorder, alkalies, with perhaps colchicum, must be given, but the acute pain will almost always be quickly relieved and removed by the chloride of ammonium, from grs. xx. to xxx. being given every six, or even every four hours. I have rarely been disappointed by it in such cases, and I know of no other remedy equal to it for efficiency and certainty.

6.—And the same may be said of a form of *Lumbago*, or aching, with severe pain on movement, in the lumbar muscles, affecting also chiefly, I think, those who have a tendency to gout. Here also the chloride will generally give very quick and complete relief.

7.—I have sometimes, but not often, met with a peculiar form of painful affection of the lower limbs, to which I do not well know what name to give. It is sometimes a legacy from rheumatic fever, but I have seen it in a patient who had never had any clearly marked rheumatic affection, and in all the cases I have met with the patient has been below par in strength, and has been either overworked or lowered by previous severe or long continued illness. During the day, he—I have seen it in men only—is free from pain and discomfort, but as soon as he has got warm in bed, and seems to be dropping asleep, he is effectually roused by a peculiar sense of discomfort in one thigh. It appears to begin in

the upper part of the thigh bone, but quickly affects the whole thigh down to the knee. It is not at all an acute pain, nor is it exactly an aching or gnawing pain only; it is rather a gnawing pain, combined with a distressing feeling of fullness or distention of the bone, and it is accompanied with a most irritating feeling of fidgettiness and restlessness of all the muscles of the limb. It entirely prevents sleep, or even physical repose, for though change of position and movement of the limb bring relief, so soon as comfort seems to be obtained by the latest turn in the bed, the suffering begins again, and so it may go on for one or two hours, or longer, making the night wretched. If I were to call the affection "a misery seated in the thigh," I should, to my own mind, describe it most graphically, though by no means exactly or scientifically. The extremities are generally rather cold, the surface of the body chilly, and the pulse weak and rather slow, or quick and irritable. Almost any diffusible stimulant—ammonia, ether, hot wine and water—will give some relief, and will shorten the duration of the affection, but by far the best and most efficacious remedy, in the full meaning of the word, is the chloride of ammonium; grs. xv. or xx., with chloric ether, will quickly remove the malady; if taken before going to bed, will prevent any attack, and if taken some nights in succession will effect a cure. Should the patient be habitually a bad sleeper, it will be well to add a little hydrochlorate of morphia to the medicine, but an eighth or sixth of a grain will be sufficient.

8.—Dr. Anstie, in the paper I have before mentioned, speaks very doubtfully of the reputed *emmenagogue* influence of the chloride. My own experience, however, and it has been very large, enables me to speak very confidently of its value in some forms of *Amenorrhœa.* In delicate and nervous girls and women, suffering from amenorrhœa, and especially when this has followed exposure to cold and wet, I almost always give it, and it very seldom disappoints me. Whether it would be a safe or useful remedy in robust country women I do not know, but in London practice it has, in my hands, proved highly valuable. And so convinced am I of its power over the uterine circulation and nutrition, that I seldom venture to give it for any purpose during pregnancy. Sometimes indeed, in instances of severe neurotic disorder in a pregnant woman, when other remedies have failed I have given the chloride, and with success, but I have heard of abortion having been apparently induced by it when given in doses not exceeding grs. xx.

In highly nervous and anæmic subjects the salt may with great advantage be combined with the perchloride of iron, especially when with the amenorrhœa there is liability to hemicrania or other neurosis. The old ammonio-chloride of iron seems to have been generally considered rather a worthless preparation. Pereira calls it "a compound of little value," and he only mentions its tincture to say that "it ought to be expunged from the Pharmacopœia," a fate which has since befallen both the tincture and the salt. But I have certainly often found a mixture of the chloride of ammonium and the perchloride of iron eminently useful; given with chloric ether in a bitter infusion, it will sometimes cure anæmia and amenorrhœa when all other medicines have either failed entirely or been of only slight service.

Again, I have given the ammonium chloride with great advantage in *Dysmenorrhœa* in highly nervous or rheumatic subjects. It quickly lessens the pain and increases the flow, and if taken perseveringly for some length of time a perfect cure not unfrequently follows. For this purpose it should be given in doses of grs. x. or xv. three times a day between the periods, and of grs. xx. or more at the periods. Unless indeed the flow, as is sometimes the case, is excessive, and then the dose should not be increased.

It frequently happens that one of the ovaries is the seat of severe pain, which is often attributed to congestion or inflammation, but which is I believe in the majority of cases a nerve disorder, a neuralgia of the ovary. This affection attacks both the virgin and the married woman; occurs most frequently in the early period of adult life; affects the left ovary much more often than the right; and is most severe at the menstrual periods, at which time it is often accompanied with considerable tenderness. But though the pain is most severe, and in some cases exquisitely intense, just before and during the time when the catamenia are or ought to be present, a paroxysm may be excited at any time by fatigue, or by any anxiety, worry, or mental emotion. In these cases sedatives, opiates, tonics, counter irritation, and the like remedies, are generally tried, and tried in vain, but, so far as my experience goes, the ammonium chloride in grs. xx. doses will almost invariably cure or greatly relieve. Dr. J. Waring Curran, in a paper on "Ovarian Neuralgia," published in "The British Medical Journal, 1868," speaks very highly of the value of the chloride combined with ♏v. doses of tincture of aconite, but I have found the chloride act quite satisfactorily by itself.

Lastly, I have found the ammonium chloride of great service in the nervousness and depression of spirits, the "chills and flushings," the giddiness, and various irregularities of circulation, attendant on the "change of life" in women. No other remedy has, in my hands, been so efficacious in removing, or very greatly and quickly alleviating, all the ills of this sort so commonly complained of during, and for some time after, the cessation of menstruation.

I may state here that after reading Dr. Anstie's paper in "The Practitioner," I sent him a note on my own experience of the remedial properties of the chloride, and especially of my conviction of its value as an emmenagogue, and he has kindly given me leave to state that he has since had some experience in its therapeutic action in amenorrhœa. He believes that it does good chiefly in non-anæmic cases. "In a very striking non-anæmic case," he writes, "of a girl of eighteen, who had never menstruated, and was a sufferer from frequent hemicrania, I lately administered grs. xx. doses three times a day, with the undoubted therapeutic effect of relieving the neuralgic tendency, and (what I believe was the equally genuine, though later produced, effect) of setting up healthy menstruation."

In all these disorders I imagine that the good effect of the medicine may be attributed to its action on the nerves, and especially on the vaso-motor nerves; and in the same way, one may suppose, it acts beneficially in the disorders of secretion and nutrition for which the German physicians administer it so frequently. I have not myself employed it much in other disorders than those I have enumerated above, but I have found it useful in the very beginning of catarrh, in chronic catarrh, and in dyspepsia with deficient secretion of bile; and on the hypothesis that, through the vaso-motor nerves, it removes irregularities of the circulation of the blood, one can well believe that it can be of great value in remedying disordered conditions of mucous and glandular secretion.

REMARKS ON THERAPEUTICS.

By William Procter, M.D., F.C.S.

There is in the present day a creeping scepticism in the matter of Therapeutics, and whilst great advances have been made in our knowledge of pathology and the causes of disease, there seems to have been a neglect of the art of treating morbid conditions, as well as of the application of remedies. This may to a great extent arise from the elevated ideas some practitioners have held regarding the results of remedies, who, not finding their expectations realised, have at once lost all confidence in drugs, and have altogether ignored treatment. But the true cause is to be looked for in the want of a therapeutical system reared on a scientific basis, the want of a means of combating disease with weapons beyond those of empiricism. How then, and to what extent, if at all, can this want be remedied?

In the physical sciences proper, truth is more easily attainable, or if it elude our grasp, the deficiency is sensible, and the nature and kind of obstacles which impede progress can generally be ascertained. But the study of disease and of the method of treating it has no strict analogy to other matters of scientific enquiry on which the intellectual world is employed. We have in this matter to contend with unparalleled complexity: constitution and temperament are always in an obscure manner modifying the action of remedies, and introducing unknown or imperfectly understood operations; and there are, moreover, general and morbid conditions of the system to be contended against, which are difficult of scrutiny. It is essential that the basis of therapeutics should be substantial, and should proceed upon some general theory deduced from well established facts and experiments, carefully observed and correlated, and obtained under varying conditions and circumstances. This is opposed to the tendencies of the day, which are rather to lay down abstract principles for guidance, to found theories on insufficient deduction from a few isolated facts, and to rely more on authorities than on unbiassed and truth-seeking observation.

Amongst the several sciences which have of late years been made subservient to therapeutics in this direction, pathology and chemistry, or rather physiological chemistry, stand pre-eminent. The one by showing the condition and character of the results or products of morbid action on which therapeutical agents exercise their influence; the other by explaining the nature of those agents, the changes which may be effected in them, and the laws by which they influence and operate on the organism with which we have to deal.

The ultimate results of diseased conditions are in the generality of cases tolerably well known; but the therapeutist requires a knowledge of the several stages before the final one, in order that he may control the transformations of nutrition which occur before the product has taken on its final pathological character, for it then becomes far less amenable to the influence of remedial agents. This addition to medical knowledge the pathologist has to work out, ere he will, to the fullest possible extent, benefit the therapeutist.

In the formation of a scientific system of therapeutics, one class of enquirers has disregarded pathology and has endeavoured to found it on some well-recognised phenomena of science, especially of chemistry. To this class belong Dr. Bence Jones in this country, and many others abroad. Dr. B. Jones classes certain disorders as diseases of suboxidation, and others as diseases of peroxidation, for the cure of each of which remedies of an opposed chemical tendency are supposed to be required. The result of this division is that articles of the Materia Medica, having very different modes of action, as well as opposite remedial powers, are thrown together; for example, the alkalies, iodine, and iron, are placed as deoxidating agents, yet taken individually, the general action of these substances is essentially different, nay, opposite, when employed in the treatment of disease. A method which fails, as this does, to explain the modus operandi of drugs, is of little value in directing their administration. The application of chemical laws alone to the solution of the question must inevitably fail, inasmuch as a method of this character leaves unnoticed important considerations which must be taken into account in the enquiry. A neglect of such considerations has led to arguments like this:—a deficiency of phosphate of lime in the osseous structure is the cause of the softness of the bones in rickets, therefore give phosphate of lime and the rickets is cured. Reasoning of this kind is not efficient to explain the

beneficial results of remedies, inasmuch as all the vital actions of digestion, assimilation, &c., are disregarded in favour of one known chemical fact.

A theory based purely on chemical principles, and which, although it reflects the highest credit upon the investigators, will scarcely be considered wide enough or general enough for the construction of a therapeutical system, has lately been given to the world in a paper by Drs. Crum Brown and Frazer, " On the connection between the chemical constitution and physiological action of salts of ammonia bases derived from strychnia, brucia, thebaia, codeia, morphia, and nicotia." The authors state that as the constitution of physiologically active substances is known, they begin by investigating the physiological action before and after the performance of a definite chemical action upon them. In effecting this, there are two kinds of action to choose between, viz., replacement and addition. Replacement, they say, appeared to produce no change in physiological activity except when the physical characters of the substance are changed, or when the activity depends upon direct local action or introduces the radical or element on which the activity depends. They, therefore, preferred to pay attention to the effects produced by addition, and the general result was that by the addition of an inert substance to one highly poisonous, the product was physiologically inert. For example, by the addition of hydrogen to hydrocyanic acid, an active poison, there results methylamine [$2H_2+HCN=NH_2(CH_3)$], a substance which is quite inert. But especially will strychnia, brucia, &c., and some of their salts, combined with methyl and other alcohol radicals, give rise to non-poisonous compounds. It was found, for example, that twelve grains of iodide of methyl strychnia when administered by subcutaneous injection to a rabbit produced no effect; and although twenty grains killed the animal it died with symptoms altogether different from those produced by strychnia.

Dr. Broadbent has likewise been engaged in a series of elaborate experiments which point somewhat in the same direction.

If then methods such as these fail to fulfil the needful requirements, there still remain open to us other modes of therapeutical investigation. And there is one mode which is essentially of a physiological character, and which has been widely adopted in estimating the action of remedies; this consists in experiments on the lower animals or on healthy man. In the abstract experiments on the lower animals are liable to manifold sources of error, and, to be of

any scientific value, demand an additional series of experiments to show an identity of action of the drug on man and the animal experimented upon. This remark is well illustrated by the statement that the recent elaborate experiments on the action of mercury on dogs has led in many minds to a distrust of their worth in the treatment of diseases in man. To give more certainty to experiments of this character the researches of Dr. Weir Mitchell are of great importance, and at the same time bear out the truth of the statement just made. Dr. Mitchell found that pigeons were almost unaffected by opium. To a large pigeon which had on the previous day swallowed ♏xxij of black-drop, he gave, between the hours of two and six p.m., gr. xxj of powdered opium made into soft pills of gr. iij each. This quantity produced no effect beyond a tendency to remain quiet, and the bird was well the next day. This experiment is only one of many, and the results have been corroborated by Dr. B. W. Richardson, who used subcutaneous injection as well as internal administration of the opium. Similarly the difficulty of affecting rabbits by belladonna and atropia is well known, and the dog is far less susceptible to the influence of the latter vegetable than man. Dr. Mitchell knew a dog recover after taking gr. xxj of atropia. Therefore experiments like those of Dr. John Harley, performed on himself, are more reliable, but whilst they afford most valuable information in relation to the pharmaceutical preparation and the dose, they are open, in their application to other individuals, to the objection that idiosyncrasy, &c., may modify results, and especially when the state of the system is altered by past or present disease.

It would then appear that in the existing state of knowledge, the true test of the value of therapeutical remedies must be clinical experience. Physiological experiments have their value and importance mainly from being suggestive, but the final decision must depend on the result when submitted to the clinical test; which must be carefully applied with due regard to all concomitant circumstances. Yet to observe correctly in medicine is a matter of no mean difficulty. It demands, in addition to practical acumen, a mind fitted for scientific observation and research, coupled with the power of estimating the true value and operation of accompanying circumstances and collateral conditions. There must exist a thorough knowledge of disease and its phenomena, as well as of the probable modifying agents, their power and influence; a knowledge of constitutions; a consideration of meteorological and local

agencies; together with the opportunity and means of observation under desired circumstances. It is not a common circumstance to find all these qualifications combined in the investigator; and it is equally difficult to have patients so situated that modifying agents may not be introduced, and in this way lead to erroneous conclusions.

Errors of this kind must certainly exist—not in the pure observation of broad results, but rather in the conditions under which the results were observed—in order to explain the high value attributed at one time to a certain drug or method of treatment, and the declaration of its worthlessness at another time. How often within recent periods has the treatment of fever fluctuated in this respect? Or take such remedies as sarsaparilla and mercury, and we shall find that professional opinion of their value and administration has undergone considerable change. Again, in matters which are now occupying much attention, such as the surgical use of carbolic acid and the therapeutical employment of bromide of potassium, a similar discrepancy is found to prevail. Whilst in the hands of certain Scotch surgeons the most satisfactory results have attended the employment of the former, in the London hospitals according to recent reports it has failed, or at least has not been followed by that success which the northern reports had led the surgeons of those institutions to anticipate. Here we have the simplest form of therapeutical enquiry, devoid of the complexity attendant upon internal administration, and yet the opinions are not unanimous; a result which on the one side or the other must follow from errors of observation. It is needless farther to multiply instances of this kind; and it may even be stated that, with some broad exceptions, agreement amongst practitioners respecting the value of a remedy is not the rule. Or if this is looked upon as a somewhat exaggerated statement, it will not be denied that wide, very wide, differences do exist; and assuming such to be the case, what explanation can be offered? Does it not arise from the want of true, careful, and accurate observation in its widest meaning? Our journals teem with accounts of this or that article of the Materia Medica being tried, but less is said of the various and precise conditions under which it was tried—these are mere empirical statements. Again, do we not too often prescribe with prejudice, or under the influence of preconceived notions which may be favourable or unfavourable to certain remedies? If on administration the remedy succeeds, it is well; or still better if the exact effects attributed to it follow; but

even then do we ascertain that the result is actually due to the drug? Or if, on the contrary, it is unsuccessful do we minutely enquire into the causes which may have been in operation to counteract the effects? It is to be feared not; but the conclusion is directly arrived at that the agent is useless, and the introducer or advocate is looked upon as a prejudging enthusiast.

The absence of accurate, scientific, and fundamental therapeutical knowledge has, in the history of medicine, led to the establishment of systems intended to be universal in the treatment of disease, but which, as of universal application, are fallacious and dogmatic in the extreme. A number of facts have for this purpose been grouped together by a one-sided selection, and these crude materials have been moulded into an elaborate hypothesis. Thus have arisen the doctrines of the antipaths, the allopaths, the homœopaths, and many others, which, erroneous as they are in their fitness and capability for general application, have nevertheless been widely accepted at certain periods and by certain individuals. The judicious practitioner, whilst he gives no adherence to such and similar teachings, and is untrammelled by illogical deductions of this character, treats his patients, as his study, judgment, and experience suggest. Yet it is devoid of a correct system—essentially it is empirical—and not in accordance with scientific therapeutics, which has yet to be developed.

With all deference to the able list of therapeutical investigators, the writer may be allowed to conclude these remarks with a few observations on the direction in which it seems to him that enquiries of this kind might be conducted, with the probability of obtaining more certain and exact results than they have at present afforded. Therapeutical experiments, it may be premised, seem to be surrounded by almost insurmountable obstacles on account of the difficulty which exists of reading results correctly, and of duly appreciating cause and effect. The first great conflicting agency is vitality, (or call it what we will,) which controls and regulates the actions and phenomena of organized beings. It is a force, but one essentially different from all physical forces; neither is it under the control of the physicist, and differs, in degree as well as in kind, from all those with which he is familiar. But if a knowledge of the operations of this vital force are looked upon as insuperable, then the progress of all biological science is at an end; and hence, in the first instance, although we may not learn their essence, the vital actions, the operations of vitality—the effects, not the cause—

should be carefully studied, and it should not be concluded that certain phenomena are inexplicable, because they are controlled, regulated, and modified by this living force.

It would not seem, after due consideration, that great practical advantage can result from researches like those of Crum Brown, although it is true that from them we gain many perfectly new facts and principles, and so far as they are developed they seem to show that agents of a certain chemical constitution may be therapeutically grouped together, as, within certain limits, that constitution regulates their physiological effects. But they do teach one important lesson; viz., to how great an extent remedies, in their operation on the animal system, may have their special action modified or annihilated by causes of which prior consideration could have given no conception. But the field is too narrow and confined, and the basis is not sufficiently extensive to aid materially in the formation of a therapeutical system.

Experiments like those of Dr. John Harley are, *per se*, of the highest value, but in the consideration of their practical application they open out one of the greatest difficulties of therapeutical enquiry. The varying effects of alcohol, arsenic, opium, and other drugs, in the symptoms they give rise to, and the quantity required to produce their ordinary effects in different individuals, is a matter of daily observation. If then conium, or other vegetable or mineral, produces a definite effect on one person when taken in particular quantities, while there is no certainty that a like result may follow its administration in the same doses to others; and if this uncertainty exists in regard to remedies whose action is eminently patent to our observation, and well marked, may it not prevail in regard to others whose operation is less marked, and whose effects are therefore not so perceptible, and thus serve to complicate the inferences which may be drawn respecting them?

These are some of the difficulties against which the therapeutist has to contend, and it has always seemed to the writer that some at least of these considerations, as well as collateral circumstances, have not been sufficiently taken into account in forming an estimate of the remedial value and operation of drugs. Nor has it been sufficiently enquired into, to what extent minor circumstances, to which no importance is or has been attached, may influence, interfere with, or modify the same. Dr. Richardson, for instance, has shown that the influence of temperature materially affects the operation of hydrate of chloral on the system. If the chemist or physicist

performs a delicate experiment, the temperature and meteorological condition are carefully noted, vessels of the same material and capacity are used, and all attendant circumstances and phenomena are minutely regarded. Moreover, the experiment is repeated several times under precisely similar circumstances, otherwise the result can with no certainty be relied on. To ensure accuracy, similar exactness should be followed in therapeutical experiments, especially when the subject of the experiment is one whose phenomena are not so patent, and in whom the attendant sources of complexity are far more abundant. The minute and accurate method of observation which is here suggested, may to some appear to be too exact to be carried out. To the busy practitioner it will be so, but it should not to those who are our teachers, and who undertake special investigations, for we cannot tell without enquiry what an important modifying influence the most apparently trivial circumstance may have in the action of remedies. It is so when inorganic matter is influenced by different agents, and why should not the same hold good in the case of organised beings? Investigations carried out in this manner may, in reference to medicine, be deemed too scientific. But if the effect of science is to give accuracy of thought and observation, caution in conclusions, care in experiment, and abolition of empiricism, then it cannot enter too largely into the constitution of medicine, nor be too widely cultivated by the practitioner of that art.

APHASIA AND ITS SEAT.

By S. Lawrence, M.D., Montrose.

The question of the localization of the faculty of speech, in other words the cerebral seat of aphasia, is perhaps by most minds regarded as still *sub judice.* The researches of pathologists, British and Foreign, during the last ten years, and the discussions which these have elicited in medical societies, as well as through the press, have doubtless appeared to throw much light around the subject; but an impartial survey of all that has been spoken and written is but too likely to produce the conviction that the true solution of the problem yet remains to be propounded. Has then "the missing link," fitted to bind together discordant facts and opinions, not yet been found? Have we not yet attained to the generalization under which all such facts and opinions may be embraced and harmonised? It may not be altogether a profitless task, on entering on a new year, to *take stock of our knowledge* on this interesting question; briefly to review the phases of opinion through which we have already passed, and to estimate the value of the position we now seem to have reached. By considering how far along the road of research and controversy we have already travelled, we shall be the better prepared to determine what stage or stages yet lie between us and the goal.

Let it then be observed at the outset that not one theory has yet been brought forward as to the cerebral seat of aphasia which well attested facts, more or fewer, have not at least *seemed* to controvert. If we take the opinion (first in point of time) advocated by Gall and the early phrenologists, and earnestly espoused by Bouillaud,—viz., that the anterior lobes of the brain are the seat of this faculty,—how stands the case? Doubtless an imposing array of facts in support of this doctrine has been advanced by Bouillaud. But it is well known that his eminent countrymen, Cruveilhier and Andral have published cases directly antagonistic to such a view.

These distinguished pathologists record, on the one hand, cases of loss of speech, where no lesion was found in either of the anterior lobes; and, on the other hand, instances of more or less extensive lesion of the anterior lobes, where there was no loss of speech. Other observers have furnished similar facts. The case of the miner recorded by M. Berard is strongly in point. An explosion from a mine splintered the frontal bones and exposed the brain. Both anterior lobes, it is said, were completely destroyed; yet the man could minutely detail how the accident occurred! But leaving Bouillaud's theory, and coming next to the view propounded by M. Dax,—viz., that the seat of the faculty of language is *somewhere* in the left hemisphere, and has nothing to do with the right,—do we find this abiding the test of strict investigation? We do not. For if in any number of cases, however proportionally small, we find aphasia co-existing with disease of the right side of the brain, the theory of M. Dax cannot be absolutely true. Now every one, even moderately acquainted with the literature of the subject, is aware that such cases have been from time to time met with. According to Baillarger, such is the pathological condition once in every fifteen cases of aphasia. In other words, in upwards of six and a half per cent. of all aphasic cases the phenomena during life, and the lesion found after death, contradict the theory of M. Dax.

Broca's theory, which comes next in order, is more precise and definite, and shall we say more captivating, than either that went before it. It is that the faculty of language is presided over, not by the anterior lobes in general, nor even by the left anterior lobe to the exclusion of the right, but by one small specific portion of the left anterior lobe. This he asserts is the posterior third of the third, otherwise named the external or inferior frontal, convolution; and consequently that aphasia depends on this select part of the cerebral substance, and no other. Do facts then substantiate this theory? It might be enough to reply that whatever negative evidence can be adduced in disproof of M. Dax's theory, it will apply *a fortiori* to that of Broca, inasmuch as the greater comprehends the less. Very curious and interesting, no doubt, and I may add perplexing too, would the doctrine propounded by Broca be, were it really true. For obviously it would import a new element into the physiology of the brain, viz., either that its two hemispheres, although presenting symmetry of structure and form, have yet assigned to their correspondent parts different and independent functions; or that, while possessing similar endowments, such correspondent parts

may nevertheless on one side of the brain have their special functions lying permanently dormant. Such a view, so entirely at variance with our hitherto established belief, and so opposed to all analogy drawn from bi-lateral or dual organs throughout the body, can only be received on evidence the most authentic and conclusive. Have we such evidence? We at once admit that numerous cases have been published during the last few years of genuine typical aphasia, the post-mortem examination of which has seemed to furnish confirmation of the truth of Broca's opinion. But that the lesion found in such cases affecting the third or inferior left frontal convolution is *not* the essential cause of the aphasia, is fairly presumable from the fact, that in other equally well marked cases of this affection no such lesion existed. It is sufficient to point to the case of Dr. Charcot, (one of genuine amnesic aphasia,) at the autopsy of which he was assisted by Broca himself. The first, second, and third left frontal convolutions were examined by both with the greatest care, and yet, we are told, they were found to have undergone no change of colour, size, or consistence; and further, that on examination with the microscope the nerve-tissue was found unchanged. To the same effect another well-marked case of aphasia recorded by Vulpian may also be referred to, where after death no trace of disease was to be found in the frontal convolutions. Again, in one of the cases published by Dr. Sanders in "The Edinburgh Medical Journal," we are told that the infero-external frontal convolution, where Broca localizes the lesion in aphasia, was scarcely touched. And more recently, very explicit adverse testimony to the views of Broca has been given in "The Journal of Mental Science," by Dr. Bateman of Norwich.

Believing that the best corrective to false or hasty reasoning on this question is the multiplication of facts, I make no apology for pointing attention to a case of "traumatic cerebral abscess" which came under my care in the spring of 1868, and was published in "The Edinburgh Medical Journal" for January 1869. Possibly it may be regarded as throwing but a *side light* upon the subject now under review; but it may not the less on that account prove auxiliary to the exposure of error and the confirmation of truth. The salient points of the case may be briefly stated. A boy, aged twelve, received an injury on the head from a fall, in May 1863, for which he was for several weeks under treatment in the Dundee Infirmary. The immediate symptoms resulting from the fall were of a very equivocal character. There was neither unconsciousness

nor paralysis. His speech was but partially affected, for while he answered questions correctly, he did so slowly, and in monosyllables. Subsequently to his discharge from the hospital, his memory and power of attention were found to be impaired; and on any slight attack of illness occurring, more or less temporary unconsciousness supervened. All defect of speech, however, had disappeared. One evening about the middle of March 1868, I received a hurried message to visit him at Rossie Reformatory in the neighbourhood of Montrose. Grave cerebral symptoms, ushered in by sickness and vomiting, had become developed a few hours before. He was insensible and speechless. Next day consciousness and speech had to a considerable extent returned, and he could answer questions distinctly. A general febrile condition now ensued, which persisted for eight or ten days with little or no change. Then speech became once more impaired, and by and bye nearly abolished; consciousness, however, being always more or less preserved. Now the sphincters lost their power, and the right arm became paralyzed. He became progressively weaker, and died on the thirty-second day after his seizure, almost five years from the date of his injury. The post-mortem examination of the brain was made for me by my friend, Dr. Howden, Superintendent of the Montrose Royal Lunatic Asylum, and I here quote the report which he drew up of that examination.

"The superior aspect of the cerebral hemispheres had the smooth, flattened appearance which is noticed when they have been pressed against the calvaria by the effusion of fluid into the ventricles or brain-substance. Over the inferior and middle frontal gyri of the left hemisphere, there was a reddish-brown discoloured patch about the size of a florin. From a fissure in this, and from the fourth ventricle over the medulla oblongata, pus exuded. On making a horizontal section across the hemispheres, the lateral ventricles were found gorged and distended with glairy pus. The septum between the ventricles was in part destroyed, and a free communication between them existed. The lining membrane of the left ventricle was discoloured, and the vessels beneath it much congested; the floor of the anterior cornu was of gelatinous reddish-brown aspect; and at this point the ventricle communicated with a broken-up, discoloured mass, extending through the brain-substance to the external surface of the frontal gyri. On further examination, the pus was found to have penetrated into the third ventricle, and then by the *iter a tertio ad quartum ventriculum* to

the fourth ventricle, and down the spinal cavity. In these latter parts, with the exception of the presence of the pus, there was no appearance of structural change."

How then does such a case stand related to Broca's theory of aphasia? We have here death resulting from suppuration and softening of the left frontal convolutions, due to a fall on the head received nearly five years before. Opinions may vary as to the nature and extent of the morbid condition in the brain-substance which followed as the result of the injury, whether *ramollissement*, or encysted abscess, or both; but that such morbid conditions had existed to a greater or less extent from the time of the accident up to the time of the fatal seizure in March 1868, I imagine no one will doubt who attentively considers the history of the case. Let it be observed then, that from June 1863, the time at which this patient was discharged from the Dundee Infirmary, to March 1868, when seized with his fatal illness, no aphasia had existed. The condition of the patient during the last few weeks of his life affords no argument *pro* or *con* on either side, seeing that the rapid extension of pre-existing disease occasioned not only the abolition of speech, but more or less of all sensorial functions. The point of the case which I conceive is specially deserving of notice in connection with aphasia is, that that part of the brain to which Broca has assigned the faculty of language, was found after death the seat of extensive disease, which in a more restricted form must have been in existence nearly five years before without producing any sensible impression on the power of speech. I repeat, *must have been in existence*, for the peculiar psychical phenomena already noticed may be regarded as conclusive evidence that disorganizing changes had long been in progress. To this extent, therefore, we may fairly carry our inference from the narrative just given—namely, that disease of the third left frontal convolution and aphasia do not hold the invariable relation of antecedent and consequent. Are we therefore to regard this case, and others of essentially cognate character, as bearing out the plausible and accommodating hypothesis of Dr. Ogle, that in some few individuals there is good reason to believe that it is on the *right* side, and not on the *left*, that the central organ of speech is situated? Or are we not rather compelled on a candid review of all the facts and reasonings which have hitherto been advanced, to conclude that all past attempts, however ingenious and persevering they have been, to localize the faculty of speech, and consequently the cerebral seat of

aphasia, have proved abortive, and from the nature of the case are destined to do so? The history of such failures, if on the one hand discouraging to those who may still feel inclined to prosecute such recondite investigations,

"Rari nantes in gurgite vasto,"

may on the other hand the more readily dispose us to accept the broader views, and to acquiesce in the more philosophical reasonings of late years advanced by another class of pathologists, among whom a prominent place is due to Dr. Hughlings Jackson and Dr. Maudsley. At all events, we shall feel ourselves encumbered with fewer difficulties, both of fact and theory, if in the meantime we subscribe to some such creed as their speculations would enjoin. To regard the supreme hemispherical ganglia as the *foci* of the volitional stimulus requisite for intellectual, as contradistinguished from emotional language, and the corpora striata as the great motor centres through which such stimulus is transmitted to the peripheral organs of speech, is more likely we think to lead to just conceptions of the whole subject of aphasia, than any more limited theory which has been advanced. We can thus understand how disease of the third frontal convolution, especially its posterior portion, from its proximity to the corpus striatum, cutting off or impairing the connection of this great motor centre with the supreme hemispherical ganglion, should greatly impair or altogether abolish the faculty of speech, without being necessitated to adopt the doctrine of Broca that such convolution specially presides over the outward manifestation of thought. And those cases of aphasia, doubtless relatively few, yet absolutely considerable in number, in which the lesion has been found seated in the middle lobe, whether in the right or left hemisphere, also find a plausible explanation in the view just expressed. For we have only to suppose such lesion to involve the efferent fibres passing between the convolutions and the corpora striata to such an extent as to prevent the due transmission of voluntary motor impulses for the expression of language, to understand how aphasia has been the result. Let me not be understood as affirming that such a doctrine must be held to interpret all the facts which for years past have been gradually accumulating on the subject of aphasia; but, looked at in the light of a *provisional theory* for the more thorough working out of the perplexing problem of the nature and seat of that affection, I deem it fairly entitled to general acceptance.

It may be alleged, however, that this more enlarged and apparently more philosophical view of the subject, while it professes to show cause why brain-lesions quite different in kind and seat may equally operate in the production of aphasia, yet fails to account for the undoubted fact that in this affection lesion of the left side of the brain so greatly preponderates over that of the right. True. And it must be admitted that this so much greater frequency of disease of the left side of the brain than of the right, has all along been, and still is, a stumbling block in the way of attaining correct conceptions on the subject of aphasia. "At present," says one writer, "there is no sufficient explanation of the almost constant occurrence of the lesion in the left side of the brain." Ingenious attempts have doubtless been made from time to time to account for this puzzling fact. We might instance the opinion of Gratiolet that the development of the left frontal convolutions always takes precedence of that of the right—a statement which other equally eminent authorities are found to controvert. I might also notice the view put forward by Dr. Moxon, viz., that since in writing, and in many other acts requiring great skill and delicacy of movement, it is the *right* arm that is almost invariably used, the *left* side of the brain is, by reason of the centripetal influence thus exerted, kept habitually in a condition of greater functional activity than the right, and is thus more prone to become the seat of disease. I will not presume to decide whether there is not a certain element of truth in this plausible hypothesis. But I apprehend that neither in attempts, longer persevered in, to connect the faculty of language with the left cerebral hemisphere, nor in such fine-spun theories as I have just mentioned, must an explanation be sought of the numerical preponderance of left-sided brain-lesion in cases of aphasia, but by pursuing a totally different line of enquiry. Leaving the specific question of aphasia altogether out of view, we must endeavour to discover *why atheroma manifests such an affinity* (if I may so express it) *for the left cerebral arteries over those of the right.* For, given the atheroma, the greater frequency of embolism and *ramollissement* on the left side of the brain are of easy explication. Perhaps we may go farther, and assert that good anatomical or other reasons may possibly be assigned, why the resultant *ramollissement* from such disease of the vessels exhibits such an apparent predilection for Broca's famous convolution and the neighbouring island of Reil; the misinterpretation of which fact has led this distinguished physician, and

others following in his wake, so hastily to adopt what seem mistaken views on the localization of the faculty of language. I repeat, it will mightily tend to dispel the darkness amid which we have so long been groping our way to just views on this whole question of aphasia, if we can discover the cause or causes which determine the occurrence of atheroma with such preponderating frequency in the left cerebral arteries over those of the right. Embolism and *Ramollissement* are but the Lake Victoria Nyanza and the Lake Albert Nyanza of this question. Atheroma is the *Lake Tanganyika.* Where shall we find a Livingstone to explore it ?

ON GASTRIC NEURALGIA.

By W. H. Day, M.D., M.R.C.P. Lond.,

Physician to the Samaritan Free Hospital, and to the Infirmary for Consumption and Diseases of the Heart, Margaret Street.

The evidence of health may be defined as the absence of sensation; an unconsciousness of the varied processes that are perpetually going on in the laboratory of the human body. In health, all is working evenly and well, the mind is light and buoyant, and the body is capable of undergoing active exertion without a sense of fatigue.

We infer that no diseased action can advance in any tissue or organ, without disturbing the balance of healthy and normal nutrition. This disturbance may be so slight and gradual, and so stealthy in its progress, that it may effect material changes, and changes of grave import, before it is recognised. Gradual degeneration of brain structure, through change in the arteries that nourish it, fatty and amyloid degeneration of the heart and liver, and other insidious and progressive diseases of decay, are instances that supply an illustration.

But none of these alterations usually go on for any length of time without pain or some altered sensation, arising either in the affected organ itself, or by reflex action elsewhere, and fortunately the one or the other is among the earliest indications of stomach disorders. Now it follows that if any impairment of function exists in the stomach it must speedily arrest attention.

There is a form of gastric pain, differing from all other kinds of pain attacking this organ, Gastralgia, gastric neuralgia, or gastrodynia are medical terms implying a painful condition of the gastric nerves. It resembles neuralgia in other parts of the body: allied to neuralgia, in fact of purely nervine origin, it seizes on the great system of organic nerves so abundantly distributed to this viscus, and becomes one of the gravest affections to contend with.

The rapid advancement in physiology of late years, has added greatly to our knowledge of the nature and causes of all affections of the nervous system, and we are now in a much better position to understand them. We now know that every change in the human body, and the due performance of each function, are dependent on the integrity of nerve strength and force, and it is when these have deviated from the normal standard, that the various tissues and organs of the body are exposed to changes of structure.

There is no limit to the extension of disease when feeble nerve influence is established. Dyspepsia and diseases of nutrition are among the commonest examples, and yet it seems extraordinary that even at the present hour we disregard to a very great extent the nerve origin of these diseases, and base our treatment on empirical and unphilosophical grounds; dwelling on the shadow, and overlooking the substance of the affection.

Nerve agency exerts a strong influence in the production of all disease. Spasm of the heart and angina pectoris have arisen from sudden shock to the nerves and emotional excitement, without a trace of organic change being found after death. A heart sufficiently strong for the purposes of quiet life, may fail under fear or shock. We see low pneumonia springing up slowly and insidiously as the nervous system is struck down by the poison of typhus, and adding to the gravity of the case. Asthenic bronchitis and emphysema creep on apace with persons whose nervous force is small. A common catarrh, occurring in vigorous health, or in those who may be said to possess strong nerves, is felt as a mere passing inconvenience, but in those of feeble nerve power, or whose nervous system is lowered by advancing life, or by any other cause, it must not be disregarded. How readily under these circumstances do the blood vessels become sluggish and overcharged in their work of carrying on the circulation, and how every effort, with the aid of the most diffusible stimulants, fails sometimes to rouse them. Pus and serum are continually being secreted, and the drain keeps up from day to day, until the patient becomes more and more exhausted, and the lung tissue becomes structurally weakened and impaired, or the heart, too weak or disturbed to struggle against opposing obstacles, soon fails to act at all.

For the last ten years, I have carefully collected all the well-marked cases of neuralgia of the stomach that have come under my observation. Some of these had been thought of trifling import-

ance, many had been given up as incurable cases, and others had been ascribed to malignant disease. In a large number of my cases, I have been able to ascertain the results of the treatment employed, and I am now of opinion, that, in nearly all uncomplicated cases, this distressing disease is within the reach of our art.

Neuralgia may arise from functional or organic causes. The nervous system may be sufficiently deranged to pervert the function of sensation, varying in degree from mere tingling and numbness to positive and unendurable pain. Angina pectoris, colic, gastrodynia, irritable testicle and uterus, are all familiar examples of altered sensation, and of agonising pain in the sympathetic system, or in one or other of its nervous ganglia. When the nerves of special sense are affected, we have tinnitus aurium, muscæ volitantes, and alterations of smell and taste.

Looking to organic change as one of the causes of neuralgia, we may have lesions of the brain or spinal cord, irritating the nervous centres, and causing pain at a distance from the seat of mischief. There is pain down the left arm from disease of the heart, or aneurismal tumours or growths arising in the midst of the nerves that are distributed to it; pain in the right shoulder from active congestion or structural change in the liver; and sciatica sometimes springs from disease of the hip-joint. A cancerous growth of the stomach in its early stages, before any tumour can be detected, or emaciation is produced, or the cachexia is marked, will cause precisely the same train of symptoms as gastrodynia arising from poverty of blood and defective assimilation.

Gastrodynia occurs under a variety of circumstances, sometimes selecting for its victims the apparently strong and plethoric, sometimes the temperate and the intemperate; but the nervous, the anxious and the anæmic, and those of feeble constitutional vigour are most prone to the affection. Mental distress is a common cause. Those who indulge largely in food and stimulants, and take little exercise are often the subjects of it. In most cases the circulation will be found at fault, and the nervous system imperfectly nourished.

Gastrodynia is usually met with in middle life, and in women more frequently than in men. It is common in seamstresses who sit for hours together in hot and confined rooms, and get neither air nor exercise; their food too is often scanty and insufficient in nutritive material, and taken hurriedly or at irregular hours. They first become sallow and anæmic, then lose all appetite, and are

unequal to the least exertion. These patients often fall into a consumption. It is common in rural districts among the poor, who drink strong and hot tea, and scarcely ever taste animal food. So satisfied am I of this, that I consider it useless to undertake the treatment of a case, unless the patient decides to abandon this beverage. A lady, who has long been the subject of epileptic seizures, attributes her partial recovery from them to the abandonment of tea, and it has happened to me over and over again to see cases of functional disorder and nervous debility kept up by this habit alone. Tea drinking, therefore, is a most common cause, and in many instances I have traced the misery to taking coffee after a full dinner.

Excessive smoking is another cause, and will keep up the pain in spite of treatment, till the habit is discontinued. So many instances of gastric pain, extreme flatulence, and nervous palpitation have come before me from this cause, that with such symptoms in young men, I never fail to enquire if this habit is persisted in, because it is so constantly at the root of the complaint.

The lower class in the north of England, who eat oat cake, suffer greatly from gastrodynia; and those who starve their nerve tissue by their dislike of fatty matter, subsisting mostly on lean meat and bread, without any material variation of their diet through the year, are equal sufferers. The following is a case among many others illustrating this mode of origin:—

Case 1.—A married lady, aged forty-three, with a grown-up family, was for many years troubled with indigestion, and liable to pain, sickness, and irritable bowels on committing the least indiscretion in diet. She was compelled to restrict herself to lean mutton-chops, weak brandy-and-water, and cocoa. This mode of living she adopted of her own accord, and rigidly adhered to it for some years, when she experienced a new feature in her case, that of persistent pain at the epigastrium, and flying pains about the walls of the abdomen, weakness of the extremities, and hysterical symptoms. She looked sallow and lost flesh, and her blood was daily becoming more impoverished. Among medicines, she sought relief in alkalies and ammonia in effervescence, and an occasional alterative pill. The case became one of gastric neuralgia. Half-grain doses of quinine in effervescence, with ammonia and citric acid, and subsequently the citrate of iron similarly combined, gave relief. No other tonics were found to agree with the stomach, and these only when administered in the effervescing form.

These cases are very obstinate, and they will not yield to treatment till the diet is improved. This patient has been persuaded to eat a mixed diet, and her digestion is now better than it has been for years, and for the simple reason that her blood is in better condition.*

The pain of gastrodynia is pecular and almost characteristic; it is referred to the situation of the solar plexus; to a spot not larger than a shilling in some cases,† whilst in others it occupies the whole epigastric region, shooting through to the back, beneath one or both scapulæ.‡

When the pain is severe and the patient has fasted some hours (and he will delay eating to escape the torture that sometimes ensues) the stomach becomes enfeebled, and there is much flatulence.

The over-distended stomach will of itself produce the phenomena, but in addition it will press up the diaphragm, and so mechanically interfere with the proper rhythmic action of the heart, causing palpitation, pain in the left side, dyspnœa, faintness, and even syncope. I have observed the muscles of the whole thorax involved, and the patient employ friction to ease his discomfort.

After these attacks (for the pain often comes on in paroxysms of

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* It now appears a secure point, that the blood is the seat of all the chemical changes that take place in the human body, and that it is mere speculation to assign to particular kinds of food the generation of muscular force, the development of animal heat, &c. It is a mixed food which best suits the purpose of maintaining healthy action, because it is most adapted for healthy blood. If it be allowed that the function of a nerve is to regulate the temperature of the body, then this property is surely dependent on the condition of the blood to endow it with this power. The blood is the starting point in all forms of neuralgia and nervous debility; poor and watery blood will starve the nerves, and give rise to every form and variety of disease.

† These are by far the most difficult cases to treat, they resist one remedy after another. Preparations of iron and counter-irritation are most applicable to this class of cases.

‡ I have very little doubt that the influence exerted by this solar plexus has much to do with the fact of the frequency of cancer in the neighbourhood of the stomach. Surely then we have much to learn about this important centre of our bodily solar system. Considerations of this kind prompt me to the belief that there may yet be a wide field of therapeutics open to us, in which we may employ remedies which may alter the nutritive process, through the agency of the vaso-motor nerves.—Dr. Wilks' Introductory Remarks on the Physiology of the Nervous System, "Medical Times and Gazette," January 4th, 1868.

severity)* patients frequently complain of superficial soreness and pain, so that they cannot bear the weight of their clothes.

Some cases are relieved by taking food, (probably from the temporary increased secretion of gastric juice,) other cases are greatly aggravated by it, and there is positive torture until the food is rejected by vomiting, or until it has passed through the pyloric aperture. In gastrodynia vomiting occurs from irritation of the gastric nerves at their final distribution in the stomach, precisely in the same way as pain is produced, but as in these cases the sufferers are afraid or reluctant to eat, vomiting is not frequent. If there were food in any quantity in the stomach, vomiting would quickly ensue, but this viscus being usually empty, and there being nothing as it were for the nerves to quarrel with, we have the characteristic wearing, gnawing pain.

In many of these cases there is neuralgic headache, as a sympathetic action through the vagus, and when this is present it greatly aids our diagnosis of the cause of the epigastric suffering. A fixed stabbing pain at the inner angle of the brow, or in one or both temples, is a common feature, and sometimes the suffering is so acute in the former situation, that there is drooping of the eyelid, lachrymation, redness of the conjunctiva, and dimness of vision. It will come on in paroxysms coincidently with the gastric symptoms, or it may precede them, or even take the place of them, in long continued cases. The pain which at first was limited to one eye or one temple, gradually involves the whole frontal region, and the neuralgic character of the affection is obscured. This form of headache is very depressing, and by its continuous character leads to great heaviness and congestion of the head, often being followed by sickness and vomiting, and the usua symptoms of a bilious attack. One patient said that headache usually preceded the pain in her stomach, and that she knew by this symptom alone the paroxysm was coming on.

The pain in the stomach is far greater than the ordinary aching and discomfort of dyspepsia, and it is of a totally different character; it is not the burning pain of gastric ulcer, nor the sharp and lancinating pain of cancer; it is a pure neuralgia, a dull, heavy, gnawing pain in most instances. One gentleman, whose case I shall

* Intermission so characteristic of neuralgic pain is better marked in cases of angina pectoris and of abdominal and facial neuralgia, than in gastric neuralgia.

relate, described it as a kind of stabbing pain of a prickly kind, most like a mild attack of toothache.* A fixed central pain, occupying the median line of the body, should be regarded as of more moment than pain that fluctuates, and is sometimes referred to the left extremity of the stomach, sometimes to the middle line of the sternum, or to the right side in the region of the liver.

When flatulence is present, the pain is not so concentrated as when this symptom is absent. If there be no habitual flatulence, this symptom almost invariably succeeds a paroxysm of suffering.

Interscapular or lumbar pain, so constant in ulcer of the stomach, is not a prominent symptom of neuralgia of this organ. In states of general debility and muscular weakness pain may be complained of in this situation, and patients suffering from gastralgia often experience it; but it bears no relation to the constancy of the epigastric pain, or the pain in the back that accompanies more severe lesions of the stomach.† No symptoms are more variable than pain and tenderness on pressure. In the earliest stages of this affection, the patient experiences a very limited and circumscribed pain, and in many cases, indeed in the most obstinate, it undergoes no change in character or position. But in by far the most numerous class, the pain extends, and by reflected irritation the cardiac nerves are involved, and the heart is disturbed in its functions.

I have observed attacks of angina pectoris and spasm in some instances, and the faintness and syncope that occur in severe cases of gastric pain are owing to extension of the neuralgic paroxysm to the heart. The gastric suffering alone is sufficient to lower the heart's action, and produce all the symptoms of shock, but that the nervous structure of the heart is sometimes involved in the way I have explained leaves no room for doubt.

It is among the nerves distributed to the liver, that pain and in-

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* It would seem, too, that persons who have long suffered from tic-douloureux, arising from decayed teeth, have had their health so lowered by the continuance of suffering that neuralgic pain has come on in the stomach, and remained very persistent. In these cases unhealthy secretions are poured out in the mouth, and food is imperfectly masticated, which contributes to the production of pain.

† Pericarditis, pleurisy, gall stones, hepatic abscess, diaphragmatic lesions, emphysema of the lungs, and a variety of intestinal causes (amongst which I have myself verified an obstruction of the small intestine, occupying the right iliac fossa)—any one of these can produce, what is strictly speaking, pain in the epigastrium, and therefore so far simulative of gastric pain.—Brinton on "Diseases of the Stomach," 2nd edit. p. 47.

terrupted function are produced in this organ. In advanced cases of gastric neuralgia, pain is frequently referred to this situation; there is uneasiness and discomfort on palpation, the patient winces under firm pressure, and describes the pain as of a gnawing, grinding character, fixed deeply in the centre of the gland. He cannot lie on his right side, and when he breathes the pain seizes the liver and darts through to the back, depriving him of rest and sleep. With the history of gastric neuralgia the practitioner should be on his guard not to ascribe these symptoms to congestion, chronic inflammation, or any other common affection to which the liver is exposed, as error in diagnosis would infallibly lead to further complication. Case 4 well exemplifies the involvement of the liver.

Short dry cough and embarrassed respiration are frequent accompaniments of this affection, and both are brought about by irritation of the pneumogastric at its distribution in the stomach. Where the disturbance in the latter organ is slight, as occurs in simple forms of dyspepsia, attention may be misdirected to the lung, and the real source of mischief escape notice altogether.

We must remember that many cases of indigestion and pain are but signs of simple debility, brought about by some conditions of the system, entirely independent of the stomach itself. The constitution may be lowered and exhausted from fatigue, anxiety, want or excess of food, or disease in some part of the body, by which the stomach is weakened and unable to perform its functions.

It cannot be too much impressed on the mind of the physician to look for all extraneous causes that may enfeeble the stomach. In the same way that the brain is overtaxed from mental anxiety, and the muscles tired from physical exertion, so does the stomach sometimes suffer from simple and genuine debility; and such debility is more scientifically and appropriately met by digestible and suitable food, than by such drugs as are presumed to minister to a diseased condition of that viscus. When such instructions are disregarded, simple debility may soon pass into persistent functional disorder, with all the well-known symptoms that accompany different affections of the stomach.

A severe shock to the nervous system can paralyze the process of digestion, and arrest the flow of gastric juice, quite as effectually as division of the pneumogastric nerves. Irritation or excitement of these nerves, whether at their origin in the brain, or at their final distribution in the great network of the stomach, will cause very similar symptoms at a certain stage of the complaint.

No greater mistake can happen than to ascribe headache, arising from slow mischief going on in the brain, to derangement in the stomach. In a common headache we have the same train of symptoms arising from very different causes. Excess of mental work or habitual despondency, by deranging and exhausting the cerebral functions, conveys an irritation through the par vagum to the stomach, and we have sickness and vomiting precisely in the same way as when the headache is due to over-eating and drinking. The brain and the stomach cannot be over-taxed at one and the same time, without risk of one or the other becoming deranged. If the brain is too much worked, the stomach must be leniently dealt with, by putting into it the most digestible kind of food, and that in small quantity.

Extra stimulants may help the worker on, and even assist his feeble powers of digestion, but such articles of diet as repair the waste of tissue that is going on, if they load the stomach, will not be digested nor assimilated. Hence is laid the foundation for subsequent trouble.

Gastrodynia is now and then attended by hypochondriacal and hysterical symptoms, and that lassitude and depression of spirits which usually attend all stomach disorders. However lively the temperament of the patient may have been before the accession of the disorder, his spirits undergo a marked change, the pain makes him irritable and desponding, and he takes the gloomiest view of himself and all around him. Anæmia is a most fruitful source of this affection, and when the disorder is recent or uncomplicated the pain ceases with an improved condition of the blood. The ill nourished nerves have got into a state of irritation which can only be permanently relieved through the agency of the circulation. When the blood has improved, and the patient has lost her pale and sallow look, we shall generally observe an improvement. I may observe here, that such cases are mostly seen among young women.

If in spite of treatment the pain continues, and the patient's health remains low, then we must institute a careful examination of the chest, as the connection is very close between tubercular disease of the lungs and this form of gastric pain.

Over and over again I have noticed this, and the result of my observations are to this end—

1. Many cases depending on simple and uncomplicated anæmia are readily amenable to treatment.

2. Among young people, if the case is obstinate and does not

yield to treatment, the apices of one or both lungs will frequently be found involved.

3. When this complication exists, the lung is almost invariably found to be in the first stage of mischief. So far as my observations extend, I have seldom known acute gastralgia in the second or third stages of pulmonary phthisis, and we constantly observe that when the lung disease has advanced to this stage, the gastric pain has often taken its departure. How this happens does not seem easy of solution, except that the broken up lung texture may possibly relieve the over-sensitive nerve, by freeing the system of a poison which deteriorates the blood and nerves.

Search must be made for any causes in operation that lower the general standard of health.

A great many so-called cases of hysterical pain are in reality instances of pain in the nerves (neuralgia), having clearly a neurotic origin, and being precisely of the same pathological significance. Such cases are met with after exhausting illnesses among women, especially if single, and there happen to be ovarian or uterine excitement. The shock to the general health is sufficient to lower and exhaust the tone of the nervous system, and thus predispose it to morbid action. In these cases it would appear that the blood is defective in quality, which, failing to nourish the nervous centres, sets up spasm, convulsion, or muscular contraction.*

There is as close a relation between gastric pain and uterine disorder, as between the latter and pulmonary consumption.

If the history of these cases is carefully enquired into, we shall find that derangement in the uterine functions is one of the predisposing causes to the disorder. It may be simple leucorrhœa, amenorrhœa, dysmenorrhœa from congestion and displacements of the uterus, menorrhagia, &c.

These unhealthy states must be enquired into, before we can expect to relieve the gastric suffering.

Case 2.—A delicate woman of twenty-three, who had just passed

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* Vide a case of "Neuralgia of the Abdominal Muscles, following Acute Tonsillitis," by the Author. "British Medical Journal," April 16th, 1864. Also a case of "Neuralgia of the Uterus, following Premature Labour." "British Medical Journal," January 4th, 1862; Dr. Ratcliffe's lectures "On certain Disorders of the Brain and Nervous System," delivered at the Royal College of Physicians, and commencing in "The Lancet," February 14th, 1863; and Dr. Inman "On Myalgia," 2nd edit. 1860.

into the second stage of phthisis, complained greatly of acute pain at the epigastrium, which made her afraid to eat. On examination with the speculum, a bleeding ulcer the size of a shilling was detected on the posterior lip of the os uteri; it was florid and granular, and the hæmorrhage from it had been very considerable. This patient had one child a year old, and three months previously miscarried. Immediately after this, and it is of frequent occurrence, the activity of the thoracic symptoms increased. Under treatment the ulcer soon healed, and, coincidently with the cessation of discharge, the egigastric pain left her. A year has elapsed without a return of pain or discharge, but she has advanced to the last stage of phthisis.

Case 3.—One of the most severe cases of gastrodynia that ever came under my notice was that of a gentleman aged fifty, who had always experienced excellent health till the spring of 1867, when after much anxiety and misfortune he lost his appetite and could not digest his food. Characteristic neuralgic pain came on at first in the night at the base of the ensiform cartilage, and prevented him from sleep. Towards the morning it passed off, leaving him faint and exhausted, yet disinclined for breakfast. It returned again at noon, and lasted three or four hours. He took a number of remedies, which afforded him no relief; he lost flesh, and despaired of ever getting better; palpitation and great cardiac excitement set in, the heart's action being irregular and fluttering, but free from bruit or morbid sound of any kind. Some relief was obtained by wearing a galvanic belt, and taking sal volatile and compound tincture of camphor three times a day. Afterwards the citrate of iron and strychnia in doses of four grains, with ten minims of chloric ether three times a day, effectually got rid of the pain. When he omitted the medicine for two days, the suffering returned, and six months elapsed before he could give it up entirely.

Treatment.—Now as medicines can only perform a part and not the whole, our faith must not rest on them alone. We shall be disappointed and defeated over and over again if we trust implicitly to any drugs or remedies. Therapeutics must advance to greater certainty before we can venture to predict a cure from medicines alone; a few there are which undoubtedly have a controlling influence over disease, and these the profession are tolerably well agreed upon. In dealing with this very obstinate affection, we must not lose sight of general principles. If the digestive

organs are much deranged and there is acidity, with a thickly coated tongue, and especially if there is pyrosis, then magnesia, soda, and bismuth, or lithia, are of service to commence with, by putting the stomach in better order and fitting it for other remedies, but these must be very cautiously given. I do not wish to underrate these medicinal agents, but I have not found any great or permanent benefit follow their employment, as they are rather corrective than curative. The irritated or primarily deranged nervous plexus presiding over the secretion of the mucous membrane, favours depraved and acrid secretions, often of an intensely acid character, which cause severe paroxysms of suffering, till either the stomach has cleared itself by vomiting, or the offensive secretions are neutralised by some of the alkalies. This allays the agony for the time being, but it would seem that the nerves once having got into this state cannot favour healthier secretion.

The prolonged use of alkalies weakens the digestive functions, by neutralising the acids of the acidulated pepsine, which is the solvent for the nitrogenous or flesh-producing aliments, and there can be no doubt that many cases of habitual indigestion are owing to the frequent and indiscriminate use of alkalies. By their sedative effect they relieve pain for the time being, in many opposite forms of gastric suffering, but if persisted in and resorted to frequently, as by many dyspeptics, they lower the tone of the mucous membrane, and impair the nerves that pervade it. When given in this affection I prefer them in combination with sedatives, as prussic acid, and very small doses of morphia. When the tongue is reddish at the tip, furred in the centre, and the papillæ prominent, particularly at the base, where they are often seen flabby and large, denoting irritation and debility of the gastric mucous membrane, bismuth is a remedy of undoubted value. When there is excess of secretion on the part of the stomach, it is prescribed to most advantage. When the tongue is clean and pale, or large and flabby, or has a glazed and membranous appearance, it does positive harm. Even here it will sometimes relieve pain for a time, but in a great many instances the suffering returns quickly, and the remedy has to be resorted to again and again, and in larger quantities, till it finally fails to afford relief. In properly selected cases small doses are sometimes beneficial, but if the case is obstinate, large doses (gr. x. to gr. xv.) will prove effectual where smaller doses would fail. I prescribe the liquor bismuthi (Schacht) with syrup of

ginger and hydrocyanic acid.* Bearing in mind the nerve origin of all the symptoms, these remedies can only be looked upon in the light of palliatives, and we must therefore strive to introduce into the system whatever food and medicines can repair the waste of the nervous tissue.

To attain this end, preparations of iron are especially to be recommended, by improving the blood, but their tendency to cause congestion of the stomach and liver often forbids their employment. The exhaustion, too, which ensues from a long continuance of pain, may unfit the stomach to bear any such preparation at first, however mild and gentle. The feeble stomach is no more tolerant of a tonic drug, than it is of those articles of food which overtax the digestive power. Many drugs may be viewed in the same light; they are excitants or irritants in the first place, and we have therefore no easy course before us, in preparing the painful organ for their reception. The citrate of iron and strychnia in four-grain doses, is the most valuable remedy I know of in the treatment of genuine and uncomplicated neuralgia of the stomach.† The combination is particularly adapted for this complaint, especially if the pain is paroxysmal. No preparation of iron or strychnia given separately has the same good effect.‡ Among the large number of patients to whom I have given it, I have derived the greatest satisfaction; and among hospital patients, I have varied it with other preparations of iron by way of experiment, without deriving

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* ℞ Liquor. bismuth. ʒj.
Syr. zingib. ʒj.
Acid. hydrocy. dil. ♏ij.
Aquæ ad ℥j. Ft. Haust.
To be taken three times a day.

Or, ℞ Bismuth, subcarb.
Magnesiæ carb. (pond.) gr. v—x.
Pulv. acaciæ, gr. v—x.
Acid. hydrocy. dil. ♏ij.
Aquæ ad ℥j. Ft. Haust.
To be taken three times a day.

To the latter may be added a few drops of sal volatile or chloric ether as the case may seem to require, and sometimes the infusion of calumbo is preferable to the water. The trochisci bismuthi of the British Pharmacopœia contain two grains of bismuth in each lozenge, and several may be taken with advantage during the day. The Vichy lozenges are also useful to relieve the distressing heartburn and acidity in these cases.

† ℞ Ferri. et strych. citr. gr. iv.
Aquæ puræ ℥j. Ft. Haust.
To be taken three times a day after food.

‡ Speaking of strychnia, Dr. Wilks says, "Its general effects on the nervous system are as disappointing as its direct effects on the stomach are encouraging, for I regard it as one of the best tonics in some forms of dyspepsia."—"Medical Times and Gazette," April 10th, 1869.

the same satisfaction. A few drops of chloric ether are sometimes added with advantage,* and to many stomachs it is well administered in the form of a pill, with or without the addition of a grain of quinine.† Occasionally in this disorder and in some other debilitated states of the system, this preparation of iron and strychnia does not agree, and lately, two cases have come under my notice, in which headache, sickness, and great nervous agitation followed each dose. The same unpleasant symptoms have sometimes resulted when the remedy was prescribed in two-grain doses. I need scarcely say that under these circumstances the medicine must be given up directly.

This idiosyncracy of habit is not to be accounted for. I have known quinine to purge, and the smallest dose of rhubarb to gripe and cause colicky pains.

Sometimes the ammonio-citrate of iron will effect a cure after the citrate of iron and strychnia has failed. I have the notes of three cases where this preparation of iron in five-grain doses three times a day was of signal benefit.

There is a mild and good preparation of citrate of iron and quinine, to which a few drops of chloric ether and a dram of syrup of orange peel are added. In feeble and irritable states of the stomach, where there is sickness, headache, and loss of appetite, this is a useful and valuable preparation. Patients readily take the medicine, the addition of the chloric ether making it very agreeable, besides acting as a gentle stimulant, and relieving oppression and flatulence if they happen to be present. In less irritable states of the stomach, the citrate of iron and quinine with sal volatile and infusion of calumbo agrees well, but if the case is very chronic, and has lasted some time, the enfeebled stomach will not tolerate this combination. At the same time that these remedies are given, counter-irritation over the epigastrium is often of much service.‡

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* ℞ Ferri. et strych. citr. gr. iv.
Sp. chloroform. ♏ix.
Aquæ puræ ℥j. Ft. Haust.
To be taken three times a day.

† ℞ Ferri. et strych. citr. gr. iv.
Conf. rosæ q. s. Ft. Pil.
To be taken three times a day.

‡ The emp. picis comp., to which three or four grains of tartarised antimony are added, answers well. The size of the plaster should be about three inches square. When eruption appears it may be removed, and reapplied when it is passing off.

In one case, attended with great anæmia and extreme feebleness of digestive power, five minims of the tincture of the perchloride of iron, given three times a day in an ounce of water, effected a cure when all other remedies had failed. I have known this remedy succeed again and again when given alone, and fail when combined with other drugs. This preparation of iron is best given in those cases where the skin is moist and relaxed, the tongue clean, and general debility a prominent symptom. A favourite formula of mine is the following.

℞ Tinct. ferri. perchl.
Sp. chloroform.
Acid hydrochl. dil. } Aa ℥ss.

Fiat Mistura. Thirty drops in water three times a day.

The nitrate and oxide of silver are not generally to be relied on, but they occasionally come to our assistance when other remedies have disappointed us. The most obstinate cases have recovered under their use after other medicines had been given in vain. They are most suitable when the tongue is clean and pale. The oxide has rendered me the most service. The following are interesting and most obstinate cases, and from the failure of bismuth, and other ordinary remedies, including the different preparations of iron, which I have enumerated, fully justify the belief that the oxide of silver was the remedy that did good.

Case 4.—H. T., æt. fifty, has had three children, the youngest being born March 1861, now ten years old. The catamenia ceased a year previously. Prior to the birth of her last child she had a bronchocele, which continued more or less for six years. On the cessation of menstruation in February 1860, she felt faint, weak, and low; she had flushes of heat alternating with cold chills. There was great pain in the right shoulder blade and back, a twisting pain at the umbilicus, great flatulence and pyrosis; there was much aching at the epigastrium, and the patient's aspect was haggard and exhausted. She obtained partial relief from bismuth, and did not apply again till November, when all the symptoms returned with increased violence. She had the aspect of a person suffering from malignant disease; she was pale, worn, and sallow; the tongue was large, flabby, and bloodless; the pulse feeble, and not more than forty in the minute; she is seldom sick, and never vomits her food; there is great flatulence and faintness; the pain is heavy, dull, and gnawing; she is always easier at night, lying down relieves her. Three years ago she brought up

a little blood, but not again since; she has no appetite, and the bowels act regularly. She was ordered small doses of steel and nux vomica three times a day, and a small blister to be applied over the epigastrium, and the surface afterwards to be sprinkled with a powder containing a grain of morphia; milk and arrowroot diet. She derived no benefit from this treatment; she was now ordered the following pill three times a day.

℞ Ext. hæmatoxyli, gr.ij.
Argent. oxidi, gr.$\frac{1}{4}$
Morph. hydrochlor. gr.1-12th.
Fiat Pilula.

Two months later she was free from pain; the pulse had risen to seventy per minute; she only suffered from occasional neuralgic headache, which a better diet and the citrate of iron and strychnia entirely got rid of.

Remarks.—This was one of those cases, notwithstanding the extreme faintness and debility, in which the smallest quantity of brandy aggravated the pain and tenderness, by paralysing, as it were, the stomach, and arresting the secretion of gastric fluid. In many irritable and painful conditions of the stomach, and especially in malignant and non-malignant forms of ulceration, brandy and other stimulants must be used with extreme caution. Power is wanted, and the forces of the circulation require greater impetus, but when stimulants come in contact with a highly sensitive or abraded mucous membrane, they may be likened to rubbing a sore on the external surface, with a foreign body, and there is as much chance of the one healing as the other. This view has led me to place the most implicit reliance on nutrient enemata in gastric ulceration; leaving the tender and highly sensitive surface unprovoked by contact with food, gives it the best chance of recovery.*

I might relate other obstinate cases which yielded to the oxide of silver.

The purified black oxide of manganese has been recommended in doses varying from five to fifteen grains three times a day, on an empty stomach. It may be given in the cases for which we prescribe bismuth, and I am compelled to say I have seen benefit derived from it, though it does not prevent a return of the complaint, like the preparations of iron, when they can be tolerated. Its action is very similar to bismuth.

* Vide a case quoted by the Author in a paper read before the Medical Society of London, May 4th, 1868, "On some Points connected with the Present Aspect of Medicine."

Arsenic is another new remedy, introduced by Dr. Leared, which I have given in too few cases to be able to give an opinion of its merits. In Case 3 it so aggravated the symptoms, and deranged the digestive organs, that the patient of his own accord desisted from continuing it. It produced extreme nausea, and heavily furred the tongue, which was habitually clean. I have not had another opportunity of trying it, nor should I be disposed to do so, till all other remedies had failed.* Arsenic is recommended by Dr. Anstie in cardiac neuralgia.

The mineral acids, which I prefer to give alone with water, are very useful in many cases of gastric pain, and where the action of the liver is sluggish. In a case which came before me of congestion of the liver, attended with pyrosis, epigastric pain and weight, and almost incessant sickness, the mineral acids combined with dilute hydrocyanic acid, acted like a charm in arresting the sickness and distressing sense of languor and nausea, after the failure of bismuth. High coloured and turbid urine is no obstacle to their administration. As the symptoms improve, the urine will become clear. I give the acids in full doses; five minims of the diluted nitric acid, and ten minims of the diluted hydrochloric acid, in an ounce of water an hour before meals. These acids now and then greatly aggravate the pain of gastrodynia, and then other remedies must be sought for. The mineral acids have often been pronounced valueless when given in combination with calumbo and gentian, whereas the bitter has disagreed, and not the acid. In cases of gastric neuralgia, I am satisfied that these bitter tonics tend to aggravate the suffering, and consequently I never prescribe them in this disorder.

In atonic dyspepsia, with inactivity of the liver, furred tongue, and want of appetite, gentian is a valuable tonic; and in debility of the stomach, and the dyspepsia of old people, calumbo is of great service; but they do not answer in neuralgia. So objectionable are these bitters to some stomachs, that I have known the most violent sickness follow their use.

In a case of congestion of the liver, with a loaded tongue,

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* The most striking effects are seen in neuralgia, where iron and arsenic are often found to produce a cure without any possibility of doubt. In this class of cases, I should say arsenic is the most valuable medicine we possess; it is difficult to foretell a cure, but in tic of the face, sciatica, pleurodynia, gastralgia, and other nervous affections, its beneficial effect is often most marked.—Dr. Wilks, "Medical Times and Gazette," April 10th, 1869.

and very disordered secretions, soda, gentian, and calumbo increased the distress, whilst the acids rectified the mischief. Later the tincture of quinine was added in consequence of debility and periodical flushing, and with marked benefit. Still later the tincture of perchloride of iron with quinine was given. It is not easy to explain this tolerance, for we know that quinine and iron tend to clog the liver, and interfere with the activity of its functions; we must infer therefore that the acids enable the stomach to bear these remedies.

For any remedy to be of benefit in a complaint like gastrodynia, it must strike deeper than mere alleviation. There is scarcely any form or degree of this affection, which will not yield for the time being to some one or other of the numerous drugs at our disposal, but no cure can be hoped for unless we aim at the root of the disease.

The blood is perhaps the first offender, being wanting in those elements that encourage a healthy and normal action of the nerves and tissues it has to nourish.

Though many cases of gastric pain come under the designation of gastrodynia or gastralgia, I would restrict the term to genuine neuralgic pain, where the tongue is usually clean and pallid, and there is little or no flatulence; where the patient in its most severe forms is struck down by a fixed and continuous pain, with a weak pulse, a pale countenance and a clammy skin, and the symptoms in extreme cases approach some degree of collapse. In every confirmed case of this affection, I have found the pulse slow and weak, beating faintly and languidly against the finger, like the returning arterial stroke after great shock or collapse. The patient has a painfully distressed look, with pinched and contracted features.

Among remedies, I must repeat that none are so reliable as the preparations of iron in their most soluble form, given with the utmost care as regards dose, and combination, and the delicate state of the digestive system.

Many cases of pain in the stomach and region of the liver are set down to be instances of gastralgia, and we hear of their ready submission to treatment. The passage of very acrid bile, or gall stones too small to be detected in the evacuations, will give rise to symptoms that may be mistaken for gastric neuralgia. Several such cases have come under my notice, but with care they may generally be distinguished. The following points of difference may be recognised.

1. The pain of gastralgia is fixed and usually limited, occupying the centre of the epigastrium; in the hepatic disorder it is sometimes confined to the liver, though it constantly occupies the median line at the root of the ensiform cartilage, and shoots through to the back, beneath the angle of one or both scapulæ, or to the lumbar and sacral regions, where the pain is sometimes very acute.

2. In gastralgia, the secretions of the liver and kidneys are not necessarily altered; in the hepatic disorder the evacuations are deficient in bile, or they contain a large quantity, and the urine is often charged with bile.

3. In biliary calculi there is often a variable amount of jaundice, and constantly a yellow tinge of the skin, coming on a few hours after the cessation of the suffering. Vomiting is often urgent, whether the stomach contain food or not, which is rare, except in very aggravated cases of gastralgia.

4. Constipation is common in both disorders, but the remedies that would relieve the one affection, would intensely aggravate the other.

When gastralgia is attended with much constipation, owing to the defective nutrition which is going on, and the sluggishness of peristaltic movement, the intestine may become loaded, and by pressing on the common bile duct, may interfere with the escape of bile into the duodenum; but sluggishness of all the vital functions, and torpidity of the organs involved in the processes of digestion and secretion, are sufficient to arrest or modify the usual activity of the liver. It will therefore be conceded that the anatomical relations of the stomach to the liver, transverse colon, and other organs, may by sympathy give rise to symptoms which are often not referred to their proper source. Though constipation in these cases is the consequence of depressed vital power and torpidity or inertia of the intestinal muscular fibre, the exhibition of iron and tonics, in the hope of overcoming the difficulty, is not often borne well; at least before they fulfil their purpose, they produce discomfort. They are essential and invaluable in improving the state of health on which the constipation may depend, but when constipation is thoroughly established, some mild and efficient aperient must be given, once or twice a week, and this by unloading the bowels is often followed by improvement, and the system is better prepared to receive the tonic remedies I have alluded to. Though an advocate for trying one or two drugs at a

time, I think a combination of them is very valuable in some disordered states, and especially in constipation. Few practitioners will doubt the increased efficacy and safety of aloes when combined with soap and ipecacuanha; and the Decoct. aloes co. may be continued longer, and with better effect, when administered with the Mist. ferri comp.

I have had no experience of the use of aconite in gastralgia, but in acute rheumatism and in neuralgia I have seen its good effects. In tic-douloureux, combined with iron and quinine it has proved very useful in my hands. Dr. Neligan speaks well of it; he says, "I have administered the tincture of aconite with decided benefit in painful affections of the stomach, whether dependent on organic disease or not, and in some obstinate cases of violent gastrodynia, which had resisted all other remedies for years, its effects were most decided, perfect recovery resulting in a short time from its use." *

In none of my cases have I ever resorted to the subcutaneous injection of sedatives, although there can be no doubt of their occasional value. In gastric neuralgia they are not to be recommended. My experience is to the effect that all sedatives are merely palliatives of neuralgic pain, and that they should be shunned if possible. A good stimulating dose of alcohol, in the shape of brandy and water, is a safer and more effectual remedy. Perhaps nothing relieves the pain more quickly than brandy, or more surely wards it off if taken a short time before the expected paroxysms.

Cod liver oil in young patients sometimes acts in a most satisfactory manner, and if there is any suspicion of a tubercular dyscrasia it should be given. Where it can be taken, which generally happens in the latter class of cases, the pain diminishes rapidly, and I have treated many cases with this remedy alone.

The following is one of the most severe cases of neuralgia of the stomach I have ever met with, and as it is so forcibly described by the unhappy sufferer, I give it in detail :—

Case 5.—A clergyman, æt. fifty-two, consulted me in March 1868, for a most painful affection of the stomach. He has suffered from gastric pain for ten years, and for the last two years the pain has become very severe. There is a history of gout in his family, his father, cousin, and himself having suffered from it. The great feature of the case is pain, latterly there has been nausea, but there is no constipation nor pyrosis. He has taken potash and soda

* "Medicines and their Mode of Administration," p. 333.

for years, which, by neutralising the extreme acidity, have given him temporary relief. There was a pale fur on the tongue, the pulse was weak, and the face pallid and careworn; there was no evidence of visceral disease. I ordered him a pill of ipecacuanha, rhubarb, and capsicum daily at twelve o'clock; and a mixture of bismuth, chloric ether, and infusion of calumbo three times a day. I also advised him to wear one of Pulvermacher's galvanic belts round the abdomen.

On the 8th of April he wrote, "I followed your instructions to the letter, and finished the medicine and pills, which I do not think were of any appreciable benefit, but I cannot help fancying that the electric chain has done me good, inasmuch as I feel more energy than I did. At first I thought that it gave me a neuralgic headache, so I left it off for a day or two, but I wear it now regularly. I continue to feel severe pain, especially about the liver, just as if I was seared with a hot iron; of course not so severe a pain as that would be, but of that description. On swallowing my food also I feel much pain as it goes down, principally at breakfast, just as if the food grated against a lot of nerves, one after the other, like as if the nervous tissue was disposed in the shape of a gridiron. I have, as I said, severe pain about the liver, especially at night, when the pain keeps continually awaking me. I sometimes fancy the pain comes from raw surfaces or ulcers in the stomach, and at times that the very acrid contents work upon the nerves in the coats of the stomach, or that the mucous membranes are "set on edge," if I may use the expression. Formerly I used to get free from pain towards morning, but now pain is never absent. If I take milk in the early morning, it directly turns acid, and brings on pain actually more than that for which it is taken. There can be no doubt about my case. I suffer continual pain, often attended with spasms over the whole chest, which pain proceeds from the excessive acidity, acting either upon a raw mucous membrane, or the gastric nerves, probably both. And the reason why I continue to suffer increased pain, is that the contents of the stomach increase in acidity, and the coats and nerves become more sensitive. I think the severe pain in the liver is owing principally to the acidity preying upon the nerves, as, when I suffer much in that respect, the imbibing of some potash with water diminishes it for a time."

On the 15th he wrote as follows:—"I quite believe the nerves of the stomach are the culprits. The acidity of the contents of the stomach affect the nerves, and cause the pain to come on. Last

night, as I fancied my stomach had some sour contents in it, I drank several tumblers of water, and emptied it completely. The consequence was I went to bed, and had no pain whatever during the night till towards morning, when I felt it sore. I then took a dose of the liquid bismuth and water, which at once took the sore feeling away. But at eight a.m. it came on again, when I took a tumbler of milk, and this made me all right for half an hour, when heartburn came on, I expect from the milk beginning to turn acid from being digested."

On the 4th of May he writes—" Yesterday in the forenoon a kind of lancinating pain came on just on the right side of the pit of the stomach. I had it rather bad in the early morning, as it awoke me out of sleep, when I took a dose of liquid bismuth and water, which took it away, but all this forenoon I have had it more or less—it seems just as if it was the aching of a nerve, something like a mild attack of toothache—a kind of beating nervous pulsation of a painful character. I hope it is not owing to any ulcer or worse. My tongue has been better lately, red, but not such a livid red as it has been at times. This pain has been perfectly independent of heartburn, which makes me the more anxious. When I take anything to drink, or a Vichy lozenge, it goes away for a short time. A gentleman recommended me to take some of Condy's fluid internally. I have done so twice at night instead of potash, and it prevented heartburn. The pain I allude to is a kind of stabbing pain of a prickly kind; it is most like a mild attack of toothache, painful, though not very much so." He was ordered four grains of the citrate of iron and strychnine in an ounce of water three times a day.

On the 16th he writes, " I am glad to say that lately I have felt decidedly better. The iron and strychnine I believe agrees well with me—my tongue is very much better; it has lost that livid red hue it had some time ago, it is now good. Certainly the inflammation or neuralgia has moderated. Though suffering much pain still at times, it is not so great as it used to be."

On the 29th he writes, " I caught a bad cold, which has made my stomach worse. I have all along had pain about my liver, as if it was enlarged. I cannot draw a long breath or even a moderate one without feeling it; the pain is not much, still it is pain. There must be great nervous irritation, as at times the pain is severe, rising from the pit of the stomach right over the whole chest. I am scarcely ever free from pain, more or less."

On the 12th of June he says, "The night before last I could not sleep part of the night from pain about the liver; when I breathed it pained me there and right through to the back, and I could not lay on my right side. Yet the next morning the pain had nearly all gone, and I breathed more easily. To-day it is there again, but not so severe. I feel the nerves shooting right across the chest and stomach. The pain goes when I take potash, from its neutralising, I expect, the acid, which preying upon the tender nerves of the stomach brings on the severe irritation. I believe the whole of the gastric nerves are in a state of exasperation." The iron and strychnine was now discontinued, and three minims of the liquor potass. arsenit. ordered in an ounce of water twice a day after meals.

On the 26th he wrote, "The first day I took it my tongue next morning was so very foul—worse than I ever knew it before—that I thought it better not to go on with it, the arsenic prescription; the last three days I have taken the strychnine and iron, as I felt myself weak and low after I left it off; I find as a tonic it braces me up. I am now using for ten minutes every morning a galvanic battery. I fancy I feel heated after the use of the battery."

On July 23rd he writes, "Ten days ago I felt such prickling in my hands that I thought it better at once to give up the strychnine and iron and the electric belt. I have not started them again yet. I still have a little prickling at times, otherwise I think on the whole I feel better; the heat of the weather, though so unpleasant to bear, I fancy agrees with me well. I have also quite given up tea." As there was a gouty history about him, I ordered small doses of iodide of potassium with the ammonio-citrate of iron and sal volatile, but it so soon caused unpleasant effects, without producing any good, that it had to be discontinued.

On the 6th of November he writes, "I am glad to say the tingling has completely left me, and the pain in the liver which I suffered from in the spring very seldom occurs. I believe that either or both the galvanic chain, and the iron and strychnine, did me much good. The coats of the stomach are excessively sensitive, and I now take the last thing at night better than half a tumbler full of lumps of ice, which enables me to get through the night pretty free from pain; I found out that ice was soothing for the pain, from having taken a quantity daily at dinner when I had some friends staying with me. Finding that I suffered less at night, I was induced to try it alone the last thing."

On the 11th of December he again writes that he is "obliged to give up the iron and strychnine, the tongue being again foul and the pain severe. I find revalenta arabica so soothing to the stomach that I now regularly take it. I have a little pain after the revalenta, but it is of short duration. I go to bed at ten p.m. and have no pain during the night, whereas were I to use any solid food after four p.m. I should be taking potash, &c., and suffering pain, 'malaise,' to the early morning. I wear a water bandage in the daytime. The revalenta binds my bowels. When I took so much potash they were regular. When the pain comes on it does so in spasms, right over the chest, darting to the liver. I now dare not take any solid food after the middle of the day. The revalenta has just turned up in my hour of need, as without it I know not how I should have got on."

On the 9th of June 1869, this patient came to see me again, and I made the following record in my case book:—"The paroxysms of pain come on much less frequently, but when they occur they are more confined to the chest than to the stomach—all pain in the liver has gone—has now similar pains in the head—has not lost flesh, and his expression is more animated, the tongue is clean and the bowels regular—has none of the acidity he formerly had. He thinks the iron and strychnine did him great good, but the revalenta arabica relieved him more than anything else; it has now lost its effects." I ordered him pancreatine and pancreatic cocoa as prepared by Savory and Moore, and the syrup of the hypophosphite of iron, quinine, and strychnine.

On November 4th he writes, "I am not better, and I cannot say I am worse, save that the pain is now more marked in my chest, where at times I suffer spasms of an acute character. At night I am continually awoke by sharp neuralgic pain in the same place. As to heartburn, I fancy it has now passed into a neuralgic stage. Lately I have had very rheumatic and gouty pains in hand, wrist, feet, ankle, and instep, but the pain not acute, and only momentary. I am always worse in winter, and dread the next six months. I have always pain more or less severe, and keep sucking barley sugar, which keeps it off for the time. I am obliged to drink two or three tumblers of potash water during the night to subdue the pain."

This case has been of such long standing and obstinacy, that, taken in conjunction with the patient's age, and a somewhat anxious life, no hope of a permanent cure can be held out. The utmost

that can be anticipated is the alleviation of symptoms as they arise, and there is little chance of this unless the diet be restricted to nourishing and non-irritating food. Only two cases at all approaching this in severity have come before me, and the suffering lasted for a period of years. It eventually passed away, leaving both patients in good health, and able to take a mixed diet of animal and vegetable food with impunity. One patient was twenty-five years of age, and the other forty-five years of age. Chronic affections of the nervous system are at all times rebellious to treatment, wherever the implicated nerves may be, but the difficulty is vastly augmented when a central origin can be traced to the great sympathetic plexus of the stomach, whose healthy influence on the complicated processes of digestion is so necessary for the maintenance of nutrition in every organ and texture of the body.

The causes of this diseased action are in many instances apparent, as we have seen, but in other instances they are not so. Neither the blood, the nerves, nor the tissues or organs in which the phenomena spring up, will account for the symptoms. The want of affinity and agreement between the tissues and nerves of the affected parts, is a probable condition that sometimes exists. If it were not so, why is it that all the other parts of the human body are abundantly nourished, and supported by the same blood, and exhibit no evidence of disease?

I cannot pursue this interesting enquiry further, but I repeat that the blood, if not the first offender, gradually becomes changed in its composition; the gastric disturbance alters the character of the chyme and the chyle; the new fibrine and corpuscles become imperfect; and the blood is rendered unfit to nourish the nervous system, and to stimulate it to the healthy performance of its functions.

CASES OF MELANOSIS.

By W. Norris, M.D.

This disease came into notice during the last half century, and since the population has increased it has been seen more frequently in England, though it is still rare. It seems to me that it has, in some measure, kept pace with the fashion for smoking, and with the wonderful increase of ironworks and manufactories.

Melanosis is a disease nearly allied to cancer, and is I think disposed to be hereditary; one member of a family may have pure melanosis, and other members of the same family may have tumours of a cancerous character.

In a case I shall relate, where melanosis affected almost every organ in the body, the first tumour removed was not black; it had more of a scirrhous character; a second tumour sprang from the cicatrix, and during life put on a similar appearance to the first, yet after death it looked perfectly black. My patient's father had numerous tubercles at the back of his neck, not melanotic; they were cauterised, and he soon died. The daughter of this melanotic patient came to me from Wales, with a hard cancerous tumour in the breast. The eldest son had an enlarged cancerous kind of lip and mouth, and went from his home to the Island of Jersey to die. The youngest son had many moles on his body, and one in exactly the same spot where the disease in his father first originated. My melanotic patient had two brothers, and they told me they were marked with numerous moles.

Until lately, most authors believed that general melanosis only occurred in persons after the meridian of life. Mr. Oliver Pemberton, in his excellent pamphlet, has related several cases that appeared before the age of thirty. I can only find seven or eight well authenticated cases in early life. One in my own practice, in a young woman aged twenty-four; another, published by my old friend and colleague, Mr. Lloyd, of Bartholomew's Hospital. And in most of these early cases the disease began in the skin, though I must not omit to mention, it has occasionally appeared

in the eyes of children and adults. I shall now proceed to describe some of the most interesting cases that have occurred in my own practice; and although my first case has been published before, and was, I believe, the first genuine, general good case, affecting the heart, membranes of the brain, and most of the vital organs, described in this, or perhaps in any other country, I shall endeavour to give, from notes and from conversations with the gentleman who assisted me in the post-mortem examination, a more minute account of symptoms during life and of morbid appearances after death than I have yet done.

Case 1.—February 6, 1817. Mr. D., æt. fifty-nine, of light hair and fair complexion, apparently in good health, applied to me in consequence of the inconvenience he felt from a tumour, situated nearly midway between the umbilicus and pubes. He told me there had always been a mole in exactly the same spot, that nine months ago the skin around this congenital mark assumed a brownish hue, and that slowly from this mole a tumour began to arise. On examination I found the swelling was nearly half the size of a hen's egg, of a clear brown colour, of a firm and fleshy feel, and ulcerated on its surface, which discharged a highly fœtid ichorous fluid. The apex of the tumour was broader than its base, which was attached to the skin by a broad pedicle. Some few months after the appearance of this tumour, several distinct brown nodules of similar structure sprung up around it, some with slender necks, others with broader bases. This singular production, which gave him much pain and uneasiness, was at length removed by the knife, and the wound went on favourably and slowly healed. In less than six weeks, the tumour again began to arise from the cicatrised surface, and felt hard and semi-cartilaginous; and very soon tubercles of a livid colour surrounded the tumour, some of them separated from, and others growing into, each other. Of the latter sort there were about forty in number, forming a mass of disease extending nearly from the spine of one ileum to that of the other, and bearing some resemblance to a large bunch of dark-coloured grapes, some of them flattened on the surfaces, and of various sizes. The prominent scirrhous-looking tumour about the size of an apple occupied the centre; the tubercles already formed progressively increased; while fresh ones arose in their vicinity. The glands of the groin were swollen, and slightly tender to the touch. This disorganisation of parts was effected in two months, and continued to increase after that period; yet the general health

of the patient was not so much impaired as to prevent regular exercise, nor did it interfere with the pursuits of business. Pains occasionally affected the tumour and other diseased parts, and an early and continued symptom was an excruciating pain complained of below the left kidney. The urine at times resembled porter, and deposited a lateritious sediment. At length the constitution began to suffer more severely, and now the countenance assumed a faint livid hue, nausea and loss of appetite came on, accompanied by restlessness and an excessive depression of spirits. Dark blue spots arose in the vicinity of a mole on the sternum; others appeared in succession on the sides of the body and the back; and very soon the forehead and scalp were disfigured with the same morbid appearances. The whole body seemed to participate in this disease of structure, and to preclude all hope of relief from any surgical operation, with no resource but palliative treatment. Reluctantly, therefore, I felt compelled to leave him to his fate.

Gradually increasing dyspnœa came on, along with a cough daily increasing in severity. The constitution soon suffered more severely, almost every function being more or less impaired, and the patient became very soon unable to leave his bedroom. All that art could do was, if possible, to alleviate his sufferings, which were excessive; but the relief that could be given was only partial. He was advised to take large and repeated doses of extract of hyoscyamus and poppy, which diminished the distressing cough and dyspnœa. He loathed animal food, as well as fermented and spirituous liquors, which only added to his feverish heat and restlessness. He frequently complained of heat, though the temperature of the skin was not higher than natural; and though his feet felt to my hand perfectly chilled, and his pulse scarcely perceptible, still he was incessantly requesting to be fanned. In this miserable state the half-sitting and half-recumbent posture was the least irksome to him. Symptoms of general dropsy had for some weeks shown themselves, and these were soon followed by an increase of restlessness, cough, and difficulty of breathing, until death closed his miserable existence.

Appearances after Death.—On making an incision through the original tumour, I found its structure to be heterogeneous; it was of a dark brown and reddish tint throughout, not very unlike the internal portions of a nutmeg. The newly-formed tumour, though during life appearing in colour and consistence much like the first, with the addition of a few black spots, after death exhibited

a true melanotic appearance. On puncturing some of the tubercles, a thick black fluid was discharged from them.

On making an incision from the upper extremity of the sternum, and exposing the ribs, a tubercle was found near the angle of one of them. By a division of this morbid growth, it was evident that the disease was not confined to the periosteum, but had extended to the very substance of the bone, for I could not cut it away.

On continuing the incision towards the umbilicus, numerous dark spots were found dispersed through the cellular substance. On opening the abdomen I found multitudes of similar tubera of various sizes. The tumours were scattered in the utmost profusion in every direction, upon the transverse arch of the colon, omentum, mesentery, stomach, and large and small intestines; on the first of which they were exceedingly numerous. In dissecting downwards I found a mass of disease, which proved to be the degenerated lumbar glands, and from which many ounces of a dark liquid, in colour something like tar, but in a more fluid state, suddenly flowed. The pancreas and the mesenteric glands were diseased in a similar manner to the other organs. The liver was much enlarged, of a very dark colour, and so altered in its structure as scarcely to be recognised; its surface was studded with large oval masses of the disease, and its substance throughout was soft and pulpy. Slight tumours of the same nature were manifest in the organisation of the kidneys.

The spleen and bladder appeared to be the only organs in the abdominal cavity exempt from disease.

On examining the chest a still more extraordinary appearance, if possible, was to be observed. The lungs on both sides were thickly mottled in larger and smaller masses, throughout the greater part of their structure. The same mottled appearance was still more vividly displayed on the heart, where the specks were more minute, more numerous, and more distinct; it was almost literally encrusted with them, and the tubera were from the size of a pin's head to that of a pea. In fact, in every part of the heart minute deposits of melanotic substance were to be seen. Some of these deposits were beneath the pericardium, others beneath the membrane lining both the auricles and ventricles, and others were imbedded in the muscular substance; some minute black spots were seen beneath the lining membrane of a portion of the vena cava superior. The pericardium and arch of the aorta partook of the disease in a fainter degree.

On dividing the scalp, many of the same diseased appearances were seen on the skull-cap, and on the fascia covering the temporal muscles. The dura mater was also studded with them, but less numerously than the mucous and serous membranes. The ventricles of the brain were nearly filled with fluid. The brain itself, as far as we were allowed to examine, was apparently free from the disease; and, with the exception of one speck on the leg, the extremities were free from melanosis.

My warmest thanks are due to my old friend and colleague, Dr. Sandwith, of Hull, for kindly assisting me in this case.

Mr. Causer, a surgeon of this town, my early preceptor, attended the patient once with me, and told me he well remembered attending his father thirty years ago for a number of small tumours, not black, that appeared between the shoulders, which were well cauterised, soon after which death took place.

Mr. Causer was house-surgeon to Mr. John Hunter, and I may mention it as singular, that he sent the patient Caswell from this town with popliteal aneurism, the first case operated upon by that celebrated man; and it is equally singular that I should have given the first melanotic heart to the College of Surgeons, and to the museum of St. Bartholomew's Hospital, as also the first specimen of diaphragmatic hernia, from the same neighbourhood. I should also wish to add to the list of specimens of disease I have given to St Bartholomew's, some small fibrous tumours that I took from the bottom of the orbits of a child born without eyes; the lids were sealed together, diarrhœa came on in a few days, the lids opened, and the child died. The mother had leucorrhœa, and I presume the child had purulent ophthalmia in utero, when both globes burst, leaving the sockets empty.

Notwithstanding that many cases of this rare disease have been published during the last twenty years, on reading them I find none in which its ravages were so extensive, and few in which all the deposits were so purely black; nor am I acquainted with any case affording so strong a probability of the hereditary nature of the disease, a view which the character of the diseases of his children confirms. The zealous Mr. Oliver Pemberton, of Birmingham, who has carefully selected the best recorded cases, and who has minutely investigated the writings of our best authors on melanosis, remarks, "As to hereditary transmission, Dr. Norris's is the only case in which the evidence seems trustworthy on this point." These additions appear to me to add fresh interest to the case. Mr. Paget tates in a letter that this case is without a parallel.

Case 2.—James Perry, of Oldswinford, near this town, a nail-maker, æt. forty-five, of sallow complexion, and thin spare habit of body; had been many years a soldier in India, and had freely indulged in the use of spirits and tobacco. He had been occasionally affected with cough and slight pain in the chest, but not so as to prevent him following his daily occupation. He returned home after a long walk and a hard day's labour; ate freely at supper, and appeared to be in the enjoyment of his usual health; a few minutes after that repast he fell down, and speedily expired. The malicious neighbours said he had been poisoned. An inquest was summoned, and I was requested to make a post-mortem examination of the body.

On opening the thorax, the lungs on both sides assumed a very dark appearance, and several strong fibrous-looking adhesions had connected them with the walls of the chest. The adhesions in some parts were very firm and extensive, so as to divide the left part of the thorax into several compartments. The upper part of the left lung was ruptured, and about a pound of dark grumous blood was effused into the upper compartment. On examining the lungs, they were very easily torn, and numberless melanotic depositions, from the size of a pin's head to a horse-bean, pervaded the great part of the structure of both lobes; all the other vital organs were apparently healthy.

It is curious so much disease should have existed in the lungs with so little constitutional disturbance. The case is novel and interesting, as sudden death from melanosis of the lungs has seldom been recorded; and it is a striking example of chronic pleuritis dividing the left of the chest into several compartments, as also of a primary formation of the melanotic disease in the lungs. Portions of this diseased structure are deposited in the museum of St. Bartholomew's Hospital, and in the Birmingham museum.

Case 3.—A young woman aged twenty-six, of fair and freckled complexion, of thin and delicate form, applied to me with the most perfect specimen of melanotic tumour I had ever seen, which originated in a mole. Three years before she came to me, her brother was much annoyed at the unsightly appearance of this mark, and he ran a pair of scissors through it, with the hope of removing it; a dark brown coloured stain, the size of a large nut, afterwards surrounded the mole. The mole began to increase two months before I first saw it, and was then as large as a moderate sized mushroom, attached by a pedicle as large as the tip of my least finger; the tumour not round, but oval and flat, black, soft, and

elastic, was situated between the shoulders. There was also a small tumour, the size and colour of a black grape, near its upper surface. I removed all the diseased parts, with abundance of cellular substance; the wound went on favourably and healed in about the usual time. I predicted, and so did one of the best surgeons of the present century, Sir William Lawrence, that the disease would in a few years return and destroy life; but although about fourteen years have now elapsed since the operation, and although a sarcomatous tumour has been removed from the breast, she has had no return of melanosis.

This is a striking case occurring from a wounded mole in early life, and the disease apparently not returning. When the disease appeared she resided very near an extensive brick manufactory, —the atmosphere being generally clouded with black smoke,— not half a mile from the situation of my patient described in the first case, and her father smoked immoderately in the house.

Case 4.—An active youth, fifteen years of age, in a grocer's shop in this town, apparently in good health, consulted me for pain in the left eye and forehead, with dimness of vision. The globe slowly enlarged for a month; the crystalline lens then had an amber-coloured appearance, and I predicted fungus was developing. He went home to his father at Penn, near Wolverhampton, and as I took great interest in the case I rode over to see him, about six weeks after he had left this town.

I found the lower part of the eye had burst, and a tumour, as large as a moderate sized apple, projected through the lids; some parts were of a dark reddish colour; other parts were of a darker hue, as if coloured with Indian ink in perpendicular streaks. It was slightly ulcerated at the lower part, bled occasionally, and at other times discharged a dark fluid.

He died within six months from the first appearance of the disease, though no melanotic deposits were found on the skin.

Case 5.—Mr. R., æt. sixty-eight, a farmer, had a scirrhous tumour on the cheek; it continued to grow for a year and a half, and became a perfectly black mass; was ulcerated on its surface, and bled freely occasionally; several black tubera formed around it. He died within two years, with great debility, and his medical attendant told me he thought the frequent hæmorrhage hastened his death.

This is the only case I have met with occurring in a rural district. He was, to use the words of his brother, a desperate smoker.

Case 6.—A man, æt. fifty-five, had hundreds of dark tubera the colour of a damson scattered over the leg, and eventually died. This man resided near here, in one of the most smoky districts in England. The case was related to me by Mr. Gutteridge, of Birmingham.

Case 7.—A gentleman nearly eighty years of age consulted me, with a large scirrhous tumour in the breast; he had received a severe blow on the part twenty years before. It progressively increased, and around it several blue-looking tubera arose, the size of large grapes, oval and flat. He did not suffer that peculiar lancinating pain generally attendant on cancer, and died about two years after the first appearance of the tumour; the constitution did not appear to suffer much from the local malady, he appeared to sink from old age. By the microscope the tumours were found to consist of cancer cells filled with melanotic matter. Cysts were not well defined. The late Mr. Langstaff told me he had never found cysts to exist in this disease.

There are several species of moles, and I think they will excite more attention than they have done; some are small, of a pale brown colour; others are larger and very black, and these are the marks most likely to run into obstinate disease if irritated. When disease begins in or near a mole, I think it is almost sure to be malignant.

The non-malignant tubera I think are generally of a small size, and remain stationary often for life; they are not pedunculated, and are of a more faint blue colour, and the health is not disturbed by the local malady. Whether these more innocent tumours, by some change in the system or by injury, may become malignant, time alone can disclose. I have patients with several on their faces; they have given them no annoyance for many years. In the cases I have described I have endeavoured to show that melanosis is sometimes combined with scirrhous cancer, at other times with encephaloid disease.

My first case displays melanosis in three of its varieties—the punctiform, tuberiform, and liquiform; the latter is I believe rarely seen in the human subject.

The persons I have found affected with this disease have been those of fair complexions; and the French have found the disease more frequently in white horses than in others. I have seen it under the tail of a white horse.

When the arteries and veins have participated in the disease,

as in my second case, pulmonary apoplexy has suddenly closed the scene. In some few cases, the vessels of the brain have been diseased, and life has been terminated more speedily by apoplexy or palsy.

It appears that I have seen more cases of melanosis than most medical men, and possibly it may be owing to my residing near one of the greatest iron and coal districts in England, where numerous iron-works are in constant operation, and the air is clouded with black smoke.

Mr. Canton some years ago favoured me with a case, where the disease displayed itself in the bones more extensively than in any other case yet published, for it occurred in many bones; and was made the more interesting by the vertebræ being found diseased, which has scarcely ever been met with before.

Horses are sometimes affected with cancerous diseases; they live on a variety of food, and are often enfeebled by laborious and long-continued exercise. I never heard of cows being affected by the disease; they live a sedentary life in cool meadows, take only mild food, grass, and occasionally turnips. This diet does not seem to favour the development of cancer, or cows with such large udders would not be free from it; which points out the utility of a mild non-irritating diet in the treatment of cancer.

Is the disease frequent in India, where the inhabitants live principally upon rice? Dr. Livingstone says it is rarely seen in Africa.

A STUDY OF CONVULSIONS.

By J. Hughlings Jackson, M.D., F.R.C.P.

A convulsion is but a symptom, and implies only that there is an occasional, an excessive, and a disorderly discharge of nerve tissue on muscles. This discharge occurs in all degrees; it occurs with all sorts of conditions of ill health, at all ages, and under innumerable circumstances. But in this article I shall narrow my task to the description of one class of *chronic* convulsive seizures. The great majority of chronic convulsions may be arranged in two classes.

1. Those in which the spasm affects both sides of the body almost contemporaneously. In these cases there is either no warning, or a very general one, such as a sensation at or about the epigastrium, or an indescribable feeling in the head. These cases are usually called epileptic, and sometimes cases of "genuine" or "idiopathic" epilepsy.

2. Those in which the fit begins by deliberate spasm on one side of the body, and in which parts of the body are affected one after another.

It is with the second class only that I intend to deal in this article.

But although I thus limit myself to one class of cases, I contend that the title of my article is correct.* I trust I am studying the

* Those who say that the two classes differ "only in degree," make a remark the truth of which is admitted. In both there are occasional, excessive, and disorderly expenditures of force on muscles, the discharge depending on instability of nervous tissue. But in what kind of degree do they differ? Not merely in degree of more or less spasm—more or less instability of nervous tissue—but also in degree of evolution of the nervous processes which are unstable. A convulsion which is general, and in which the muscular regions affected are affected nearly contemporaneously, must depend on discharge of parts in which the nervous processes represent a more intricate co-ordination of muscles in Space and in Time than those parts represent, which, when discharged, produce a convulsion which begins in one limb and has a deliberate march. My speculation is that the first class differs from the second in that convolutions at a greater distance from the motor tract are discharged.

general subject of convulsion methodically when I work at the simplest varieties of occasional spasm I can find. Cases of unilateral convulsions are unquestionably the simplest. We can, when we are luckily present at a paroxysm, watch the march of the spasm. I have known a fit of this kind last ten minutes. (Case 5.) For instance, we may first see movement of the index finger, then of the hand, then of the whole arm, then of the face, leg, &c. Besides, patients can describe the onset and much of the march of such seizures. We can therefore compare and contrast these convulsions with hemiplegia—which form of palsy the convulsion not unfrequently leaves. In some of these cases we find *gross* disease of the brain (see Case 7, syphilitic nodules) *post-mortem*, and thus we can infer the seat of the minute changes on which the discharge producing the spasm was dependent. This done, we have, as in Case 7, on the one hand a record of the events occurring in a certain kind of convulsion, and on the other hand a knowledge of the internal part diseased. We are freed, therefore, from the great vagueness of the word "epilepsy." We do not care to say that a tumour of the brain (or minute changes near it) had "caused epilepsy," but that changes in a particular region of the nervous system—say in the region of the left middle cerebral artery—led to convulsions, in which the spasm began in the right hand, spread to the arm, attacked next the face, then the leg, &c.

I chiefly wish to show in this article that the most common variety of hemispasm is a symptom of disease of the same region of the brain as is the symptom hemiplegia; *viz.* the "region of the corpus striatum." The loose term "region of the corpus striatum" is advisedly used. Hemiplegia shows damage (equivalent to destruction) of the motor tract, hemispasm shows damage (equivalent to changes of instability) of the convolutions which discharge through it. Palsy depends on destruction* of *fibres*, and convulsion on instability of *grey matter*. As the convolutions are rich in

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* The word "destruction" is scarcely the correct word to use. By it is not meant that the nerve fibres are necessarily broken up, although they often are in palsy, but simply that there is a change in them which *destroys their function*. Thus, see page 170 and 187, palsy is supposed to follow a convulsion because the axis cylinder of the nerve fibre has temporarily lost its function, from the effects of the excessive quantity of nerve force it has had to "carry." Here the nerve fibres are not physically destroyed, since the palsy quickly passes off. With this qualification the word destruction may be conveniently used.

grey matter I suppose them to be to blame, in *severe* convulsions at all events; but as the corpus striatum also contains much grey matter I cannot deny that it may be sometimes the part to blame in slighter convulsions. Indeed if the discharge does begin in convolutions, no doubt the grey matter of lower motor centres, even if these centres be healthy, will be discharged secondarily by the violent impulse received from the primary discharge. Now both these parts—the corpus striatum and many convolutions—are supplied by one artery, the middle cerebral or Sylvian, and this artery circumscribes the region I speak of.

By hemiplegia in this article is meant the common form of hemiplegia, the result of destruction of part of the corpus striatum or of part of the optic thalamus. I shall, however, illustrate by hemiplegia due to disease of the corpus striatum. As we usually see hemiplegia there is partial paralysis of the face, (scarcely more than a little weakening of the cheek,) a trifling turning of the tongue on protrusion to the side paralysed, and weakness of the arm and leg of the same side as that on which the face is paralysed. But in *complete* hemiplegia, say of the right side—complete in range I mean—there is turning of *both* eyes to the left, turning of the head to the left, turning of the face to the left, (and some weakness of the right orbicularis palpebrarum,) weakness of the right side of the tongue, palsy of the right arm and leg. In large lesions the muscles passing from the trunk to the limbs are paralysed also.

The muscles which suffer most are those which can act independently of their fellows of the opposite side. Those which must act along with their fellows of the other side—for instance the intercostals—do not suffer at all; and those which are, so to speak, half way in their action—*e.g.* muscles which turn the two eyes and the head to one side—suffer only in very large lesions, and then but for a short time, a few hours or days. It is but putting these facts in another way to say that parts suffer directly as the actions they engage in are voluntary, and inversely as the actions they engage in are automatic. This is seen in the order of recovery. The muscles serving in the more automatic actions recover first. Now just the same principle applies to cases of hemispasm, so far as this at least, that the fit begins most frequently in those parts which suffer most in hemiplegia. This point is now to be considered in some detail.

Fits beginning unilaterally may doubtless begin by movement in any part of the region which is paralysed in hemiplegia, *i.e.* in

the face, in the arm, or in the leg. But I know few cases of fits of this class which begin other than in the side of the face, (usually the cheek,) in the hand, or in the foot. They very rarely begin in the upper arm, or in the calf. The fit usually begins, it is to be observed, in that part of the face, of the arm, and of the leg, which has *the most varied uses.* (I use the term *varied,* instead of voluntary, non-automatic, and the like, as it carries fewer special implications.) Moreover, taking numbers of cases of convulsions which begin unilaterally, the same law, if I may so call it, is exemplified. Fits beginning in the hand are common, fits beginning in the cheek and tongue are less frequent, fits beginning in the foot are rare. The law is to be exemplified in details. For again taking numbers of cases, the fits which begin in the hand begin usually in the index finger and thumb; fits which begin in the foot begin usually in the great toe.

The above mentioned facts are obviously very significant in regard to what is under different aspects variously named "co-ordination," "grouping," "localisation," "plan of structure of nervous organs," &c.; although it may be that the order of frequency mentioned points merely to an order of frequency in liability of parts to become diseased. I have considered such cases from this point of view, ("Medical Times and Gazette," December 14 and 21, 1867, August 15, 1868,) but now I have to speak of the bearing of the facts in the study of convulsions.

Parts which have the most varied uses will be represented in the central nervous system by most ganglion* cells. I say most

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* Although both the nerve fibre (axis cylinder) and the ganglion cell "store up force," it is the latter which stores it up in large quantity, and to instability of grey matter, therefore, will be chiefly owing the excessive discharges in convulsions.

Herbert Spencer, "Principles of Psychology," 2nd edition, page 25, supposes that "the masses [*i.e.* the grey matter] unstably constituted and conditioned, are seats of *destructive* molecular changes, and disengagement of motion; while the stably constituted and conditioned threads, [axis cylinder,] are the seats of molecular changes that are not destructive, and are probably *isomeric.*" The following quotation is very important with regard to my subject. Indeed the fact that parts which have most varied uses suffer most and first in convulsion is an illustration of the view expressed in the quotation. "Each vesicle, or each portion of grey matter that establishes a continuity between the central termini of fibres, is not *merely* a *connecting* link: it is *also* a *reservoir* of molecular motion which it gives out when disturbed. Hence, if the composition of nerve is determined as above indicated, [see Part 20 of his "System of Philosophy,"] it follows that

varied movements, as it is not only a question of number of movements, but also of number of *different* movements.

We shall speak of three varieties of convulsions beginning unilaterally :—

1. Those beginning in the hand.
2. Those beginning in the face and tongue.
3. Those beginning in the foot.

The seizures occur in all degrees. There may be, for instance, twitching limited to the thumb and index finger, or the whole body may be convulsed. In the same patient we find all degrees. The fit may stop, so to speak, at almost any stage, and indeed (as in Case 4) it may be artificially stopped by a ligature in its earliest stage. Admitting that the fits occur in all degrees, we may conveniently take three degrees for consideration.

1st. The spasm attacks only the unilateral muscles of the side in which it begins, say the right.

2nd. It passes on to the bilateral muscles of both sides.

3rd. It goes still further, and attacks the unilateral muscles of the other side—the left—and probably the bilateral muscles of both sides a second time.

To say that the seizures "occur in all degrees" is not a vague statement when qualified as above. There are not merely degrees of more or less *quantity* of spasm. The point of significance is that the spasmodic movements are not contemporaneous, but follow a distinct march, and a different march according as the spasm begins in the hand or in the foot. The sequence is, however, not simple. The spasm does not affect the arm, then cease, next affect the face, &c. It is a *compound sequence.* For instance, the face begins to be affected before the spasm of the arm ceases.

When observing the paroxysms we have therefore to note two things.

First, the region affected; for instance, we say the face, arm, and leg of one side are in spasm.

Secondly, the order in which parts are involved; for instance, we say the spasm began in the hand, passed up the arm, then attacked the face and lastly went down the leg—" out at the toes," one of my patients said.

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in *proportion to the number, extensiveness, and complexity of the relations*, simultaneous and successive, that are formed among different parts of the organism, will be the *quantity* of molecular motion which the nerve-centres are capable of disengaging." The italics in both quotations are mine.

It will be best now to give clinical illustrations, and I shall add to each case remarks on such subjects as tongue biting, loss of consciousness, and hemiplegia. These digressions are necessary for the main argument, but are most conveniently placed near the reports of the cases.

Case 1.—*Occasional spasm in the right arm beginning in the index finger and thumb.*

A married woman, forty-three years of age, but looking ten years younger, consulted me at the London Hospital, Dec. 13th, 1864. I use largely in the following the patient's own expressions. Exactly a week before, at nine or ten a.m., her right fore-finger and thumb began to work, and the working continued up to the elbow, and then all the fingers worked. (She imitated the movements by alternately shutting and opening the hand). There was no other attendant sensation. I enquired carefully for giddiness, temporary defect of sight, for abnormal feelings in the face, leg, &c. The fit was strictly localised as above described. She had had three attacks, and after each the hand felt "heavy and dead," and for some time she could not use it well. For instance, she could not "feel" the needle on the day of her visit (the third fit having been the night before).

She was healthy-looking, and had had good health, but said she was nervous. At the next visit I found no albumen in the urine. I have no note of any examination of the heart. There were two circumstances which may be supposed to have had an influence in the development of the fit. She had weaned a baby, aged eleven months, three days before the first fit. She had suffered from ascarides several years. My object at present is, however, to give illustrations of varieties of hemispasm, and the question as to the causation of the fits will be discussed later.

On her visit December 20th she had had another attack, beginning in the whole of the fingers of the right hand at once, and after this to February 20th, when I lost sight of her, she had had no more attacks.

Now the most utilitarian question we can put about such a case is,—Will a patient suffering so little have more fits, and will they be severe, *i.e.* general?*

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* After this was in type I sought the patient out. She still looks in very good health and feels quite well. There is no cardiac murmur. Since I saw her she has had *severe* fits. These began a year or two after I saw her, and she had three or four a year, but none for the last eighteen months. She describes their onset just as the onset of the slighter ones is

I never saw the patient again, and therefore I can only speculate as to what would become of her. My impression is that she would have fits extending to the whole of the side, and possibly general convulsions. I think so because we sometimes see patients the subjects of severe convulsions, who for a time had had slight seizures such as Mrs. R. had. I have recorded such a case ("Medical Times and Gazette," January 31, 1863). In that case the fit began in the index finger of the left hand, and I remember the patient told me that before the attacks were severe, he thought so little of the twitching of the hand that he used to show it to his fellow workmen as a curiosity. In the same journal, June 6, 1863, I have noted another case in which a severe fit occurred one month after a warning of movement of the first two fingers of one hand. But I cannot be sure Mrs. R. will have more fits. It may be that many people have such local twitchings, and that they remain "a curiosity" only, and do not send them to a doctor. I therefore ask those in family practice, who can watch patients longer than a physician can, if they can give records of cases in which such attacks of spasm have continued thus local, and therefore comparatively unimportant, for some years? I may say, however, that I should never declare a patient to be safe who had attacks, even so slight as this woman had. I am not referring to cases where there is what is called "live blood," nor to the fidgetty movements of the limbs which occur in weak, and especially in aged, people. Nor do I speak of cases where, without spasm, the patient becomes occasionally numb on one side—as he may say, "dead." These last named cases are not cases of spasm at all; they are probably cases of very slight palsy, and have a different clinical significance. Such symptoms occur in patients who have valvular

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described in my notes taken six years ago. In these severe attacks the arm "drew up" so strongly that no one could hold it down—her husband tried "with all his strength." When the arm was much drawn up she became insensible. She did not bite her tongue, and her speech was not affected before she lost consciousness, nor when she came to herself. The arm was weak after the attacks, but there seems to have been no considerable loss of power. She was evidently anxious, and I did not like to make her uneasy by questions which might increase her dread that she should become paralysed. All the severe attacks have been in the night. She says she has had no slight attacks such as she had when attending at the Hospital, but it seems she really has, for she is occasionally awakened at night by "starting" of the *right* arm, and sometimes of the right index finger only—that finger in which the fits, slight and severe, have invariably begun.

disease of the heart, in patients who have renal cachexia, and occasionally in people who seem to be quite healthy. They point, I believe, not to instability of ganglion cells, but to destruction—slight in amount—of nerve fibres.

Case 2.—Fits beginning in the right hand. Loss of power after a seizure.

William G., aged eleven, a healthy-looking boy. July 1, 1864. Yesterday, his mother said, a shaking began in his right hand, first in the fingers, and then it went up to the eye (orbicularis doubtless). It lasted for five or ten minutes. In the night the boy was awakened by another attack of the shaking, and his mother, who saw him when it was over, found that he could not speak. How long he remained speechless is not known, but next morning he could speak, and had two or three more trifling attacks in the hand.

Whilst I was taking these notes a fit came on. There was only a little twitching of the right hand for about two minutes. He stood through it, and talked when questioned. I saw nothing wrong with the face, but he felt "it" in the right side of the face and in the region of the orbicularis palpebrarum. The leg was, as in the other fits, not affected. The arm was weak when the fit was over, and he could not by any effort pick up a pin with his hand.

Four years before, he had had attacks on the right side for several weeks, but his speech was then in no way affected.

He spoke a little thickly, but this was always so with him, but his mother fancied he spoke a little worse than he had done the day before.

I heard of him again in February 1867. He had had one fit in the interval betwixt February 1865 and May 1866. He was in service.

This boy seemed to be in good general health, and I could arrive at no conclusion as to the cause of his seizures.

REMARKS ON EPILEPTIC HEMIPLEGIA.

The cases I am describing are those cases of chronic convulsions which are so often followed by hemiplegia. It is the epileptic hemiplegia of Dr. Todd. I do not know how it is that some patients have no palsy after these seizures, and some have. The same patient is hemiplegic after some of his seizures, and not after others. The presumption is that the degree of palsy depends

on the severity of the convulsions, *i.e.* on the *quantity* of discharge. When the convulsion is limited in range, the palsy left by it is limited in range. This is seen in Cases 1, 2, and 5. I have recorded a case (" Medical Mirror," September, 1869,) in which palsy of the arm only followed a convulsive seizure—the spasm, according to the patient, being limited to that limb. In this case there was a new growth in the hemisphere in the hinder part of the superior frontal convolution. (Compare with Case 5.) When the fit is severe, there may be hemiplegia complete in range, except perhaps for deviation of the head and eyes. But the hemiplegia, however complete in range, and however decided in degree, is transitory, and we may very safely tell our patient that it will pass off in a few days or weeks, and we may usually say so when we feel certain that the fits are the result of organic disease in the head. The palsy does not depend directly on the organic disease, (see page 187,) but is doubtless the result of "overwork" of the nerve fibres which pass from the part discharged to the muscles convulsed. The nerves and the muscles require time to recover from the effects of the sudden and excessive discharge.

But although we can assure our patient that his palsy will pass off, we shall be obliged to confess that both his fits and the palsy will *probably* return again and again.

It is not said that hemiplegia after a convulsion is transitory, but that hemiplegia after a convulsion deliberately beginning unilaterally is transitory. Hemiplegia after a convulsion may signify large cerebral hæmorrhage destroying the motor tract, and then the palsy is permanent, or it may signify plugging of the middle cerebral artery.

Case 3.—Fits beginning in the left hand. Some fits arrested by pressure on the limb.

A healthy-looking lad, seventeen years of age, came under my care July 8, 1868. Six months before, he had been struck on the buttock, but he suffered next to nothing from the blow, and went on with his work. Probably the blow had nothing to do with the symptoms he afterwards had. He had "not been well since," but he looked well and could give no definite statements as to the nature of his supposed ill-health. Six months later—a few days before I saw him—on a Thursday, when helping to kill a bullock, and after being at work about half an hour, the left hand "began to work;" there was, he remarked, "gentle movement of the fingers." He showed it to his mother

but did not stay with her. Soon he had to call to his brother to catch him. He became insensible, and bit his tongue. In a quarter of an hour he was seemingly well, having no headache. On the Friday, about seven a.m., the arm began "to work" again, but his brother "touched him on the wrist," and then the "working" stopped. He went on with his work and kept well until about half-past five, when a similar movement occurred; he called his brother, who caught him. He had a severe fit, but in an hour could walk about again.

I gave him a dose of oil of male fern, but he passed no worms.

July 15th. He had had a single movement of the hand, but it was stopped by pressure. I saw him no more after August 5th. He had had no further seizures.

In this case there was no headache, and I discovered no changes in the optic nerves. The patient was very healthy-looking, and except for the fits I found nothing the matter with him. I gave the dose of oil of male fern by routine.

REMARKS ON TONGUE-BITING.

In connection with this case I may mention tongue biting. It is no sign of "epilepsy" in particular. It is found in convulsions from uræmia and from cerebral hæmorrhage; indeed in all cases of convulsion, *when the convulsion is severe.* It is, therefore, of no real diagnostic value. It simply signifies that the patient has had a severe fit. It is not often found in the convulsion of cerebral hæmorrhage—one reason being that it is not often looked for—as the convulsions are not usually so severe as are many convulsions otherwise caused. It is not a diagnostic point to be relied on, even in the convulsions of young patients. A convulsion in a young man is usually epileptic, *i.e.* usually depends on minute changes which will not lead to a fatal result. But tongue biting does not help us to that diagnosis.

It is not easy, it is usually impossible, to get a look at the tongue in cases of coma, but we can often infer that it has been bitten from the presence of blood on the gums and from bloody foam. (Bloody foam, however, is seen in some cases of rapidly fatal cerebral hæmorrhage without tongue biting; it may come from the lungs.) We should always look at the tongue at *post-mortem* examinations of those who have died from cerebral hæmorrhage. We may find that

there is bruising without laceration. The other day I made an autopsy with my friend Mr. Herman, on a woman who had died from cerebral hæmorrhage which set in with a convulsion, and we found a dark plum coloured patch the size of half a bean on the left side of the tongue. An incision showed extravasated blood.

Case 4.—Seizures, partial and severe, beginning in the right thumb. Arrest by ligature. Dyspepsia.

A single woman, twenty-two years of age, consulted me, August 23, 1869, for fits.

Each fit begins by movement in the thumb of the right hand, and by degrees the whole arm is involved. The same side of the face is drawn, and the head is drawn towards the arm, which is raised to meet it. The patient's remark is, "it seems as if it wanted to draw the arm into the head." "It" goes to the leg after the face has begun to work, and then she becomes insensible; the insensibility she ascribes to the severe pain in the muscles ("sinews" is the word she uses). This observation is of value as showing that the pain from the cramped muscles is severe. She foams at the mouth and bites her tongue. When she comes to herself she speaks well. She cannot walk well after the attack, but this is attributed to giddiness and headache. She says the right arm and leg are affected, but only slightly. There is at least no decided hemiplegia after the seizures.

The above, however, refers to severe fits, and the description is necessarily incomplete, as she becomes insensible as soon as the right leg is attacked. The probability is that in the severe attacks she is convulsed on both sides after the first (right) side is fully seized. She has slighter seizures, or, as she said at the next visit, November 1, "I have had no fits, but the hand has been very fidgetty, and I have had to tie it up twice." December 14, she said she had had no fit for six weeks, but the hand had been "very bad," and she had had to "tie it up." She added, "But it (tying) makes me feel giddy."

Then on January 4, 1870, she had a fit of intermediate severity. To use her own words, she had had "workings of a fit," but did not become insensible. The spasm affected the arm and the side of the face a little. It did not get to the leg, and there was no drawing of the head to the right. The arm was "tied up"; first a ribbon was tied tightly round the middle of the forearm, and, as this "would not stop it," the ribbon was next tied around the middle of the upper arm—"this kept it from taking my senses away." The arm was

"tied up" for two hours; for when untied "it drew up;" when tied it kept quiet.

The bromide keeps the attacks off. When I saw her last she said the arm had been "very peaceable."

The foregoing is little more than physiology—medical physiology it is true, but still physiology. The important clinical facts are to be added that she is dyspeptic, and suffers very much from flatulence. It seems clear to me from her spontaneous remarks at several visits, that when she is flatulent the arm moves more. This point will be again referred to with regard to the question of "cause." There is no heart disease. Her sister is far advanced in phthisis, and the patient herself is phthisical looking, has a cough, and her respiration is harsh over the clavicles. She is quite regular.

DYSPEPSIA IN CHRONIC CONVULSIONS.

Dr. Paget of Cambridge in a lecture on "Gastric Epilepsy," "Lancet," April 11 and 18, 1868, says, page 491, "In epilepsy once established, whatever may have been its exciting cause, gastric disorder may, in the course of the case, become the ordinary exciting cause of the fits." He relates cases in which remarkable benefit followed care in dieting and remedies for dyspepsia.

I have been led to advise epileptics to limit their quantity of *flesh* food since reading Professor Haughton's researches on "The Relations of Food to Work." The following quotation will serve to show how I suppose his work bears on the dietetic treatment of epileptics. "The hunted deer will outrun the leopard in a fair and open chase, because the work supplied to its muscles by the vegetable food is capable of being given out continuously for a long period of time; but in a sudden rush at a near distance, the leopard will infallibly overtake the deer, because its flesh food stores up in the blood a reserve of force capable of being given out instantaneously in the form of exceedingly rapid muscular action."

ARREST OF FITS BY THE LIGATURE.

Case 4 is specially interesting, because the patient gave a clear account of the use of the ligature. There can be no question that the ligature is a most valuable means of arresting such fits. I have known very great success from this procedure in Brown-

Séquard's practice, and also from another plan he adopted, founded on the same principle, viz., circular blisters—a garter of blister round the limb.* Probably the ligature, &c., merely put off the explosions; and patients the subjects of this, as of other varieties of fits, very often say that they feel better *after* a seizure—after a full discharge of that part of the nervous system which is unstable. It indeed occasionally happens that an epileptic complains more to his doctor when his fits are diminished in number. It may be that when his serious troubles are lessened, he thinks of the smaller ones. But I suppose that before the abrupt explosion which constitutes the severe fit there are frequent minute discharges—too trivial to produce any visible effects, but enough to cause discomfort to the patient. Nevertheless it is a gain to put off the fit—to save the patient from the *effects* of the discharge, especially to save him from the sudden violent stoppage of respiration and its secondary effects on the circulation in the head. It is reasonable to suppose that, whilst the fits are kept off by treatment, we may, by much exercise, by purgatives, by care in diet, and especially by giving a very simple diet (milk, vegetables, and little meat), prevent the diseased part of the nervous system from arriving at that high state of tension which permits severe convulsions.† (See page 173.)

I presume that the first outward spasm is the result of the beginning of the internal discharge. It is an interesting question how the sensation which so often precedes the spasm is related to the seizure, and how the ligature averts the seizure. It is quite

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* Pulling against the spasm, *e.g.*, opening the clenching hand, will sometimes put off the fits. In other kinds of seizures, when the fit begins by a general warning of confusion in the head, the patients can shake them off by walking about, stamping, &c. I have several times heard patients remark to this effect, "I nearly had a fit, but I managed to shake it off." "It nearly got the better of me." See an interesting article by Dr. Buzzard, "*On the interception of the epileptic aura by blistering.*" "Practitioner," October, 1868.

† I find, however, that a great authority, Niemeyer, says, "On the whole, compression of a limb from which the aura seems to proceed is not advisable, even although we may avert a fit by so doing, since, in the first place, the patient feels worse after thus repressing an attack than if he had had one; and in the second, because his next seizure is apt to be one of unusual violence." I quote from the translation by Dr. Humphreys and Dr. Hackley of New York. The observation of the patient (Case 4,) that tying up the convulsed arm made her feel giddy, is interesting in this connexion.

certain that the ligature will avert fits when they depend on *organic* disease of the brain—"coarse" disease—(see Case 8); and in any case it is unreasonable to suppose that a local irritation starting from the hand is the *sole* cause of the seizure—that it can provoke discharge in a *healthy* nervous system. It is to Brown-Séquard that we are indebted for our precise knowledge of the relation of external irritations to the production of convulsive paroxysms. He finds that experimental injuries of the spinal cord of guinea-pigs—section of one lateral half is the most certain—produces after a few weeks a condition of the nervous system which results in a convulsion when an external irritation is applied to a certain part of the face. In the case of his epileptic guinea-pigs there are obviously *two* factors in the production of the paroxysm—first, a permanent lesion of nerve tissue; secondly, an external irritation. It may be supposed, then, that in such cases of convulsion as I have described, there are also two factors, (1) an irritation starting from the fingers which travels to (2) the part of the nervous system unstable, and then determines the discharge.* I have now under my care a patient whose case seems to support such a view. He cut the palmar surface of his left index finger with a gouge. (There remains a hard scar to the present time.) *Nine months later* he had a severe convulsion, beginning in this and in the next finger. (I do not give the other particulars of his case, as they would be for all practical purposes a mere repetition of those given of Case 4. His fits always begin in the same way, and he has both full and partial seizures.) But cases are numerous in which external local irritations exist without the occurrence of convulsions of any kind. It seems most reasonable to suppose that the man whose case is just noted has permanent disease of the opposite side of his brain, and that, at the most, irritation from the injured finger acts on it only as the explosion of a gun cap does on the charge in the barrel.

It seems certain that external injuries bring about tetanic spasm, but then they very rarely do, and I think the inference is at least plausible that those in whom a local irritation developes tetanus

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* And as a corollary we may suppose that in health there is not only a relation by motor fibres from the corpus striatum to the muscles, but a relation by sensory fibres from the skin covering these muscles, and from the muscles themselves, to the (vessels of the ?) corpus striatum. This supposition seems to me to be but an amplification of Hilton's well-known hypothesis of the supply of skin and muscles from nerve trunks.

have already some abnormal condition of the nerve centres for the local irritation to act upon.

The subject calls to mind cases I many years ago heard related by Mr. Paget, in a clinical lecture, of neuralgia, set up by injury, persisting when the nerve to the injured part was divided. It seemed as if the injury to the nerve had led to permanent changes in some connected part of the nervous centres, for the patient continued to "feel" pain in the injured part when it was quite anæsthetic from surgical division of the nerve trunks leading to it. Similarly it may be that the injury by the gouge, in the case of convulsion just mentioned, produced slowly the very changes* in the patient's brain on which the convulsions depended.

I think, at all events, that other conditions determine the discharge in some cases, when the spasm is quite local. The unstable equilibrium of the patch of unstable nerve tissue may, I imagine, be upset in many ways, see page 202, and possibly one way may be by an irritation starting from the region which is afterwards convulsed.

Case 5.—Partial convulsion beginning in the right hand.

This case has to me very great interest, because I witnessed the paroxysm. The march of the spasm was very deliberate: the time occupied was about ten minutes. Seven of these minutes were measured by the watch, the rest were guessed. The fit was incomplete, but from the observation of other cases, I may safely state what the order of events would have been if the convulsion had gone on to a severe fit. The patient's head and both his eyes would have been turned to the right, the right leg would have been convulsed, the chest would next have been fixed, and then the convulsion would have "repeated itself" on the left side. The convulsion on the left side would, however, have been less severe, and the parts would have been affected, I believe, more contemporaneously. It is to be observed that the bilateral muscles of the face were involved in spasm as well as the unilateral. (See pages 191 and 192.)

* "The general mode in which an eccentric irritation passes over into convulsion is the same in each instance, viz., by inducing the peculiar organic condition upon which the paroxysm depends. An impression made upon an afferent nerve determines, not only in it, but in the centre to which it is attached, an interstitial change; and this latter is the cause or essential condition of a motor impulse, which is transmitted along a motor nerve to the contractile fibres of the muscles or the vessels. In such conversion of impression into motion, we have the simplest idea of a 'reflex' action. —Reynolds' "Epilepsy," page 18.

A man, forty-eight years of age, was admitted for convulsive attacks, which he described very minutely. They were, by his description, like that on which the following observation was made. One day when waiting his turn to be seen by the physician, his right hand began to twitch, the thumb and index finger taking the lead. The fingers were soon partially flexed in a curve, except the index, which was straight, but flexed at its metacarpal joint; the thumb was straight too, but flexed also at its metacarpal joint, and lay with the palmar surface of its terminal segment against the side of the index finger. Next the whole arm twitched, but it did not rise; the exact sequence of involvement of its several parts was not ascertained, as the man was dressed. In about two minutes from the first, the right side of the face began to twitch, but before movement of it was discernible the patient said he felt "it" in his face. The right eye was closed, the right cheek was drawn up, and both jaws came together. The mouth was drawn to the right, (but whether before or after the meeting of the jaws was not noted,) and its opening was ovoid, the wider end of the ovoid being to the right. The right ocular aperture was a little closer than the other, but both were narrowed. Both sides of the forehead were wrinkled upwards. There was no deviation of the head nor of the eyes; the leg was not affected, and the patient could talk in any part of the fit. He begged me to let the porter take hold of his hand—to unclench it—as the porter could manage it better. The fit ceased very suddenly. After the attack the arm, which was weak before the fit, was completely paralysed, quite limp, and fell forward when he stooped, and it had not recovered completely when he left the hospital fourteen days later. The patient's speech was not distinct before the fit, but it was worse after. It is not possible to say anything more definite about his speech than this, as the patient was a foreigner; what he said could be made out.

ABSENCE OF INSENSIBILITY IN CONVULSIONS.

In the above case there are many points of interest. I shall now speak only of the absence of insensibility in the seizure. These are the very cases of convulsions in which so often there is no loss of consciousness. As before said, these seizures occur in all degrees, and when they are partial the patient may be conscious, although sometimes speechless, throughout. So far as I can ascertain, the rule is, that (when the fit begins in the hand) consciousness is lost

as soon as, or just before, the leg is seized, but sometimes the whole side may be affected, and even, I believe, the thoracic muscles slightly, without any loss of consciousness. It has been said by the late Dr. Addison, of Guy's, that absence of insensibility in convulsions is some evidence that the internal lesion is organic, such for instance as tumour. I have had no autopsy in any case of the class of fits which I describe in this paper in which I have not found organic disease. For all that, I cannot hold the opinion which this great physician has expressed. *Such convulsions point only to minute changes involving instability in the opposite hemisphere.* If the reader will not admit this, it suffices for the present argument to say that they point only to *local* changes of instability. They tell us nothing of the pathological processes by which that local instability results, or, in narrower terms, they give no information as to whether the changes are primarily minute, or secondarily minute, *i.e.* changes due to the irritation of a foreign body.* To tell whether the changes are diffused from a foreign body, such as a syphilitic lump, a tumour, &c., we have to consider a very different kind of evidence (see page 196). If the patient have severe pain in the head—not the mere sequel of a convulsion,—if he have vomiting, above all if he have double optic neuritis, I should then think it probable that the convulsion depended on changes diffused from a foreign body in the brain. If he have no such symptoms, I should suppose the local change was not diffused from a foreign body.

Patients with minute local lesions of the brain are not likely to die under our care. A patient with a foreign body in his brain very often dies under our care. Partial fits—fits without insensibility—very often occur without symptoms implying a foreign body, and I can therefore place no value on absence of insensibility in such seizures towards the diagnosis of organic disease. If we work in the wards of a hospital only, where we find patients who are admitted for *severe* intracranial disease, we shall be misled. We must work also in the out-patient room, where we see patients year

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* I use the term "foreign body," as I use also the term "coarse disease," to include glioma, syphilitic nodules, hydatid cyst, blood-clot, abscess, &c. It is used as the opposite of minute changes. When a patient comes to us for any symptom implying that there is disease of some kind inside his head, the first attempt is to find where it is; next to determine whether it be constituted by primarily minute changes, or by changes (softening) diffused from a "foreign body;" and after this is done, we try to find out the particular pathological nature of the foreign body, whether it be glioma, syphilis, &c.

after year with fits of the kind above mentioned, and without any symptoms to lead us to suppose that there is "coarse" disease of the brain.

So far I have spoken of cases in which the fit begins in the hand, and it will have been observed that in some the fits began in the thumb and index finger. This is (as remarked at page 165,) the rule. I could, however, give several instances in which the fit has commenced in the little finger, but their recital would make the paper too long. These fits are, however, rarer. I next pass to cases in which the fit begins in the side of the face, or tongue, or both.

TEMPORARY DEFECTS OF SPEECH WITH CONVULSIVE SEIZURES.*

In all cases of convulsions beginning unilaterally, it is important to consider carefully the side of the body in which the fit begins. We find that when persistent *loss* of speech occurs with *hemiplegia*, the hemiplegia is nearly always of the right side. I have long observed of convulsions that when spasm begins on the right side there is defect of speech more marked than when it begins on the left. However, my facts on this matter depend very much on the observations of the patient or his friends. The friends of patients very naturally do not always distinguish betwixt mere inability to talk or defective speech, and insensibility or confusion of mind. The patient is sometimes said to be speechless for a time, and sometimes is said to talk badly. The patient very often remarks that as soon as the fit begins, he cannot speak. I must say that there is sometimes no complaint of defect of speech when the seizure begins on the right side. But I think it will be found that, when the spasm starts in the *face and tongue* of the right side, there usually is great defect of speech, and that there usually is not when it starts in the *right hand or right foot*. It may be supposed that the loss or defect of speech is owing to locking of the articulatory muscles by spasm in the fit, or to palsy of those parts after it. We shall be able to settle this by observing if equally great defect results when the spasm begins in the *left* side of the face and tongue. It is unlikely that the speech defect after the seizure is owing to

* "There is a peculiar class of cases of epileptic hemiplegia, in which the exciting cause of the epileptic fit at the same time damages or greatly injures voluntary power and speech." Todd, "Nervous Diseases," Lect. XV.

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partial palsy of the articulatory muscles, since total palsy of the face and tongue on one side from disease of the portio dura and ninth nerves does not cause either the same kind or the same amount of difficulty of talking which we now and then find following a fit. My impression is that in the right-sided convulsion there is often considerable defect of speech, and in the left-sided convulsion at least rarely. I am obliged to use the word "impression" as I have not often had the chance of observing patients soon after these seizures. The subject is one on which it is particularly dangerous to draw hasty conclusions. I by no means urge its consideration with the hope of confirming the view held by many, that disease in the *left* hemisphere only, causes loss or defect of speech. (The fact of real significance is, that extensive disease in but *one* hemisphere can lead to total speechlessness.)

I beg those who have the rare good fortune to see patients in such seizures, or quickly afterwards, to note the nature and degree of the defect of speech. It is important also to set the patient during the continuance of his defect of speech, to write, and we must not be satisfied with his writing his name or copying. Persons who have permanently lost speech from destroying lesions of the left hemisphere, may do both when they cannot write to dictation nor anything "out of their own heads." * We should also ask the patient to read.

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* It is a great mistake to suppose that a speechless patient can write, that is, write in the sense of expressing himself, because he can sign his name, or because he can copy what is put before him. It is *a priori* incredible that a person who cannot speak should be able to write. For when we write we merely translate nascently revived words into written symbols. We have to speak "inside ourselves" first. (Cases of loss of talking from immobility of the articulatory organs are of course not here in question.) When a patient does not utter a word, and yet writes well, *and swallows well*—this fact showing there is no considerable palsy of the articulatory muscles—we may be almost certain, (quite certain, I believe,) that he—it is usually *she*—is pretending, or that the defect is "hysterical," whatever that word may mean.

The fact that an aphasic person cannot write must not be brought forward as *additional* evidence on his mental condition. It is the *same* defect as loss of speech in another manifestation. The speechless man cannot read, not even to himself. It is not that his eyes, or rather the parts of the brain which contain processes for the recognition of images of things, are affected, for he does recognise objects, and when he cannot read, can recognise headings, (*e.g.* one of my patients could find in a magazine volume the continuation of a serial tale,) and knows by the handwriting where a letter

Another thing to be noted is, that in cases (see Case 2) where there is great defect of speech after a seizure we are sometimes told that the patient talked badly long before he was subject to fits, although he talks worse after a seizure. This does not do away with the significance of the defect of speech after the seizure. I suppose that the previous defect of speech implies a weak spot in the nervous system, and very likely the fits are the result of ingravescence of old-standing disease in the same region. This, however, is only a speculation.

Case 6.—*Convulsions beginning in the face. Defect of speech.*

Elizabeth F., nine years old. June 25, 1866.—The child was brought to the out-patient room by her mother on account of fits. Before I spoke to her the mother made a statement to the following effect, which I give as nearly in her words as I could write it down. "This child has had fits. The first was two months ago. It begins in the right eye; then her mouth opens; the face draws up to this side," (pointing with her finger to the child's right cheek). "Her hand draws up to her head, and her leg works. She cannot talk when it begins, and it has altered her speech a good deal." In reply to a question the mother said the child was not at all insensible in the attacks. I asked her how she knew that, as the child could not talk. She replied, because the child could tell her what had happened during the fits, instancing without questioning that the child knew who was there and what was done. She also said that during one fit she (the mother) being distressed shed tears, and when the fit was over the child spoke to her of her crying. In reply to an enquiry, she said the fits would last ten minutes, and on my expressing my incredulity she very quietly added that she had "timed them by the clock." (See Case 5). I now made enquiries as to the details of the fit. It would begin in the midst of talking or singing. Although the face was the first to twitch, the fit began by an aching in the hand, and the arm "dropped." After the face had begun to twitch the arm drew up. She never bit her tongue.

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comes from. The difficulty is still one of loss of speech. Written and printed words, strictly, have no meaning. They are merely arbitrary signs of words. They require translation into words, and into an *order* of words. This translation the speechless man cannot effect, as he cannot revive words. He understands what we say to him, as, although *he* cannot revive words, the sounds of our words revive the motor symbols of words in his brain—*i.e.* in the undamaged side. For the speechless man is not wordless; his defect is that he cannot revive words *voluntarily*.

The defect of speech continued after the fit had passed off. It was, she said, a sort of stammer, and would affect her sometimes all day after severe fits. She had never been subject to stammering before. She would sometimes have seven fits in the day; would have two in the night, and might miss a day. After the fits there was weakness in the right side, so that she could not walk nor use the hand, and she always found the hand weak for writing.

She was a well-formed, good-looking, light-haired, intelligent child. She looked delicate, but she was fairly nourished, and I could find no signs of general ill-health. She had walked when about fourteen months old, and it is said that she talked when eighteen months old. She had never had scarlet fever, nor rheumatism, nor measles, and a careful examination of her chest did not disclose any signs of pulmonary or cardiac disease. The optic nerves were normal. She had, however, "earache,"* and now and then discharge from the ear, and sometimes complained of headache.

She had headache in a morning, but this symptom was not one which the mother mentioned without questioning. There was not that severe and continued headache which would lead to the suspicion of "coarse" disease. (See foot-note, page 178.) There had been no vomiting. Her temper was reported to be very good, and she seemed intelligent.

July 2nd.—Yesterday the twitching came on "for a moment," it affected the face and hand. July 16th.—No fit except many slight twitchings of the face and arm.

It is needless to go on with the report. On December 31st she still had the seizures, severe ones as well as slight ones, and I fear she has them still.

As the difficulty in talking was described as a "stammer," it may be said that it was not of an aphasic character, but "merely"

* We not very unfrequently find disease of the ear with "epilepsy," but it is rare to find it with fits like those considered in this paper. The attacks are scarcely ever well described, and we mostly only learn that the patient has occasionally a severe convulsion. This fact is of importance as being some evidence that loss of consciousness is the first thing, and as leading to the inference that the discharge is of parts at a distance from the motor tract. We know that disease of the ear leads occasionally to *abscess* of the cerebrum, or of the cerebellum, and I imagine that it may lead to *slighter* changes—of instability—in these regions, which changes may allow convulsive attacks. It is possible that this patient's fits (Case 6) may have such a causation. On this subject I have made remarks "Brit. Med. Journal," June 26, 1869.

a difficulty in articulation, and that it did not depend on disease of the left cerebral hemisphere. That such a symptom depends on temporary changes in some part of the Sylvian region I have no more doubt than I have that hemiplegia after such seizures is so dependent. I say nothing of the particular part of the hemisphere in fault, since even from cases of destroying lesions—*e.g.* clot—producing permanent *loss* of speech, I have only been able to conclude that the disease on which that loss is dependent is in the region of the corpus striatum, mostly, I admit, involving Broca's convolution. I am satisfied that the absolute distinction made between cases of "genuine" aphasia and certain cases of difficulty of articulation* is at the least arbitrary, and I think misleading. With decided and permanent hemiplegia of the right side, we find *all kinds and degrees of defect of speech.* We find all degrees of defect of speech, from difficulty of articulation to complete speechlessness, without any palsy of the articulatory muscles themselves. At least the articulatory muscles are not obviously paralysed, and they serve quite well in eating and drinking, swallowing, smiling, laughing, &c. We may reasonably expect then to find, after convulsions beginning unilaterally, all or many degrees of defect of speech, from difficulty of articulation to complete loss of speech, just as in these cases we find all degrees of loss of power in the arm from what the patient calls a "deadness," to utter immobility. I may fairly beg those who see patients who speak badly after such seizures to *describe* the kind of talk. To say it is "not of an aphasic character" is unsatisfying. To describe speech defects is, however, one of the greatest difficulties in clinical investigation It is com-

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* I cannot believe that there is any adequate reason for the popular separation of symptoms into "mental" and "physical." Everyone admits that there are degrees of evolution of sensori-motor processes, from those which are comparatively simple to those which are exceedingly compound, and the terms "physical" and "mental" may be convenient, but only as names for large *degrees* of difference. I presume that defects of articulation and loss of speech occurring with hemiplegia, besides differing on account of the quantity of nerve tissue destroyed near the corpus striatum, differ also according as the part destroyed is, or rather was, one serving in simple or in highly compound processes.

Besides degrees of *loss* of speech from *destruction* of nerve tissue, there are to be considered degrees of *disorder* of speech from instability of nerve tissue. Loss of speech is analogous to hemiplegia. Disorder of speech is analogous to hemichorea. This is quite a different distinction from that into "ataxic defects" and "loss of memory for words."

paratively easy to set down on paper an account of the phenomena of a case of *complete* speechlessness, but it is very difficult to give a faithful picture of slighter defects. We usually observe in the difficulty of speech which follows a convulsion beginning unilaterally, that the patient hesitates, and slurs words; his talk is mumbling. We hear ourselves that he talks badly, but when we attempt to put down on paper what the nature of the defect is, it seems to melt into nothing. For of the above statement the reader may well say that hesitation, slurring, and mumbling are very common things. Even such a description is better than the use of such terms as, "He was manifestly suffering from great impairment of speech," or, "His speech was of an aphasic character." These expressions are only verbally definite. When, however, the patient does not talk badly when we see him, we must be content to put down what he or his friends tell us, and we shall be obliged to use loose expressions. But we must bear in mind that they are loose.

CONVULSIONS BEGINNING IN THE FOOT.

The next group is of cases in which the spasm begins in the leg, and it usually begins in the great toe. Sometimes, however, the patient will say it starts from the calf. I shall relate no cases of this kind.* They are rare, and I have never witnessed a paroxysm. The point of great interest is the march of the spasm. Fits which begin in the foot have a different march from those which begin in the hand, although in each the same muscles are ultimately convulsed. When a fit begins in the hand it goes *up* the arm and *down* the leg. (The sequence is not simple; see page 166.) Now patients who have fits beginning in the foot tell me that the spasm goes *up* the leg and *down* the arm. I have no doubt they speak accurately, as I ask no leading questions and different patients tell the same tale. In some, however, insensibility comes on just after the leg is fully affected—the last patient I saw with this kind of seizure used the expression, "when it gets to my heart." Here we have two seizures, in each of which the same muscles are engaged, but in each in different order. The two sorts of fits are "isomeric." Another matter to observe is the kind of hemiplegia which follows fits beginning in the leg. This is a rare sequel of such fits, and I have no notes of any such cases. The leg is often partially para-

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* I have recorded a very striking case, ("Lancet," May 16, 1868,) in which fits beginning in the great toe were stopped by rubbing the calf, &c.

lysed for a time after fits so beginning, but of the condition of the arm and face I can say nothing. On these points I ask for information.

Again, I have had no *post-mortem* examination of a patient who had had fits beginning in the foot, and I am very anxious to learn where lies the disease which causes such seizures. I suppose that in most cases we should *discover* no internal disease, but we are likely to discover changes when the fits have occurred in a patient who had suffered intense pain in the head, and who had had other symptoms implying "coarse" disease. In the fits which begin in the hand, I have found, when there has been intense pain in the head, &c., "coarse" disease of convolutions in the region of the middle cerebral artery. (See Case 7.) Is the disease on which fits beginning in the foot are dependent, in the region of the thalamus opticus?

Again, I think it of importance to consider the side of the body in which the spasm starting in the leg sets in. My reason is this, that mental defect (imbecility) sometimes occurs with hemiplegia in which the leg suffers more than the arm,* and I believe that it occurs oftener when the left is the side paralysed. I fully admit that my facts on this matter are very few, and I therefore ask others to help me in this part of the investigation.

THE CAUSE OF CONVULSIONS BEGINNING UNILATERALLY.

We now come to the question of cause. The word "cause" is used in various senses in medical language, and we shall therefore discuss the following points.

1st. The seat of the internal lesion.

2nd. The nature of the changes in nerve tissue on which the spasm *directly* depends.

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* Trousseau, speaking of those cases of hemiplegia in which the arm recovers more rapidly than the leg does, remarks that the patient is worse off than when the reverse obtains. It is not quite clear that Trousseau refers to failure of intellect. I think he does, for he relates in illustration the case of a man who died in a state of perfect imbecility, and he predicted that the woman whose case was the text of his lecture would die within the year a thorough imbecile. It is important to observe that the man had excruciating pain, and this symptom also Trousseau believed would follow in the woman's case. The late Dr. Bazire, in a foot-note to Trousseau's lecture, speaks of the case of a patient who was seen in private practice by Dr. Ramskill for hemiplegia like that Trousseau spoke of. In less than a year this patient died "completely demented."

3rd. The pathological process from which these local changes result.

4th. The circumstances which may determine a paroxysm.

1.—*The seat of the internal lesion.* The fact that the symptoms are local, implies, I hold, that there *is* of necessity a *local* lesion. I submit that one-sided spasm, or spasm beginning in one side, implies *local* change in the central nervous system as surely as one-sided palsy does. It may be plausibly asserted that there is no local lesion in those chronic cases of convulsion where the spasm is general and also contemporaneous, or nearly contemporaneous. But in a case like Case 4, where the fits always start on one side and always in the very same fingers, it is simply incredible that there is no persistent local lesion. The fact that the patient is seemingly quite well betwixt the paroxysms does not negative this view in the least. No fact is better recognised than that a large part of one cerebral hemisphere may be *destroyed* when there are no obvious symptoms of any kind.* Why then should the apparent good health of a patient betwixt his fits (see Case 3) lead us to conclude that his brain is healthy in the intervals of the paroxysms? He had a fit, let us say, a week ago, was hemiplegic after it, and is now seemingly quite well again. But it is next to absolute certainty that he will have another fit soon, perhaps next week, which will begin exactly as the last, will follow the same march as that did, and may again leave him temporarily hemiplegic.

I have no doubt that many readers will grant what I affirm, and will think it quite needless to try to prove that local symptoms imply local lesions. But I know well that others will say that the fits in many cases of unilateral convulsions are "caused by" disorder of the digestive organs, by fright, by overwork, by mental anxiety, and by like *general* conditions, and will assert that there is no local lesion. Similarly fright, which is a general condition—the whole body suffers—is said to be a "cause" of chorea. It cannot surely be the cause of hemichorea. They will affirm of such a case as Case 4, that the nervous tissue which explodes in the fits is healthy, and that its equilibrium is upset by general bodily disturbances

* This is I believe agreed on by physicians, but it may be well to refer to recent observations. See a most able paper in Vol. I, of the Pennsylvania Hospital Reports, by Dr. T. H. Andrews. Dr. Andrews relates a very important case which occurred in his own practice, and gives particulars of seventy-two cases. See also Callender, "The Anatomy of Brain Shocks," St. Barth. Hosp. Reports, Vol. III.

which derangement of digestion, &c., produces. I assert, on the contrary, that there must of necessity be some *place* where the nervous system is diseased, or the spasm determined by causes acting generally would not be local.

The fact that palsy after convulsive seizures beginning unilaterally disappears quickly is certainly no proof that there is no permanent local lesion. In the first place it is notorious that in many cases in which we have observed transitory hemiplegia there is found *post-mortem* gross disease, say, syphilitic nodules, of the cerebral hemisphere. (See Case 7.) Disease in the hemisphere never causes palsy *limited to one side*, unless it also involves or squeezes the motor tract. It may, if very extensive, cause general weakness, and more weakness of one side of the body than of the other, but never distinct hemiplegia. It does not cause hemiplegia, that is, by *destroying* a large part of the hemisphere. It very frequently *leads to hemiplegia by convulsion*, and in cases of coarse disease the passing off of the palsy shows that it did not depend on destruction of nervous tissue by the coarse disease, for the coarse disease remains. The palsy depends on secondary changes near the coarse disease, or rather on the "overwork" of nerve fibres by the excessive discharge on them which these secondary changes permit. The recurrence of the fit and of the hemiplegia shows that the secondary changes are there still.

It will be observed that the statement is not that hemiplegia does not *attend* lesions of the hemisphere; it *frequently* does. (See Case 7.) The assertion is that hemiplegia does not result from *lack* of the part of the hemisphere *destroyed* by the disease. Niemeyer (" Medical Times and Gazette, "Jan. 15, 1870,) believes that hemiplegia does not result from lesions of the cerebral hemisphere and that hemiplegia *occurring with* lesions of the hemisphere is owing to the " secondary participation of the district of the corpus striatum and thalamus opticus."

Let us suppose that a square inch of convolution is diseased. If this part were destroyed, there need be no symptoms; but if it be not destroyed, but unstable, there must be symptoms—for it will *discharge* on muscles when its tension reaches to unstable equilibrium. If the discharge be excessive, the nerve fibres will require some time to recover from this " overwork," and in the meanwhile the muscles which have been convulsed are paralysed.

Another objection will be advanced, *viz.*, that in some cases of unilateral spasm we find no local change in the brain *post-mortem.*

Many will think this argument conclusive. I have not yet seen an autopsy on any chronic case of convulsion beginning unilaterally without finding obvious disease in the brain, but I have had few *post-mortem* examinations in these cases, and I grant—not for the sake of argument only, I will admit it—that in most cases, probably in nearly all those in which there is no severe pain in the head, no optic neuritis, &c., that we should *discover* no changes *post-mortem.* I should still believe in their existence. I should not expect easily to discover the minute changes from which results only an *exaggeration of normal function.* It is the function of nerve tissue in health to "store up" force and to expend it in an orderly manner at the provocation of special excitations. The discharge of disease differs from the expenditure of nerve force in health, in quantity, and in that it is provoked by a more general excitation. And even in those cases where we *do* find a lump in the brain—in Case 7 for instance—we do not discover the *very* changes on which the discharge depends. The lump does not discharge, but some ("softened") part of the brain near it—which part cannot be destroyed or it would not discharge at all, but which part must be diseased or it would not discharge so much, nor in so disorderly a manner, nor on slight provocation.

So far I have only attempted to prove that there is a local lesion, but incidentally proof has been advanced as to the exact locality of the lesion—that the disease is in the region of the corpus striatum. The fact that hemiplegia so often follows such fits, is further proof. In some cases the palsy is exactly like that which follows plugging of the middle cerebral artery.

I have now to mention that when the fits begin in the hand, (see Case 7,) if we do discover a gross lesion, it is found in the region of the corpus striatum—in the region of the brain supplied by the Sylvian artery. It may seem to the reader that this fact is sufficiently conclusive to render unnecessary the former arguments. But I doubt not that many will not accept the fact. Some will reply that disease of *many* parts of the brain "will produce epilepsy." This is really irrelevant. I will not deny that disease in many parts of the encephalon "may produce epilepsy." I wish but to show that disease in the Sylvian region produces those convulsions which begin in one hand or in one side of the face, and which affect the side of the body they commence in, before the spasm spreads to the bilateral muscles, and to the unilateral muscles of the other side.

There is a more definite objection. It is held by some that the

coarse disease, although it lies in the cerebral hemisphere, is quite as much an *eccentric* cause of a fit, as is a worm in the duodenum; and that in both the medulla oblongata and pons are the centres which discharge. (I do not deny that grey matter in these parts is *secondarily* discharged.) When we consider that the hemiplegia left by the fits I describe is like that following *destroying* lesions in the Sylvian region, and is not like that following destroying lesions in the pons or medulla oblongata, it becomes, I submit, infinitely more probable that the primary discharge is of grey matter in the region (Sylvian) in which the coarse disease is discovered.

Although to me the above arguments seem sufficient, I will consider certain objections.*

If a small number, or let us say a square inch, of convolutions were cut away by the knife, there would be no loss of power, no paralysis. This is admitted. How then can discharge of this square inch produce violent convulsions? If lack of the part leads to no *loss* of function, how can discharge of that part lead to *excessive* function?

As nervous processes ascend in complexity, the number of fibres of necessity increases, and at the same time the number of ganglion cells. Moreover, the ascent is not one of aggregation—different in-

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* It is asserted by some that the cerebrum is the organ of mind, and that it is not a *motor* organ. Some think the cerebrum is to be likened to an instrumentalist, and the motor centres to the instrument; one part is for ideas, and the other for movements. It may then be asked, How can disharge of part of a *mental* organ produce *motor* symptoms only? I say motor symptoms only, because, to give sharpness to the argument, I will suppose a case in which there is unilateral spasm without loss of consciousness. But of what "substance" can the organ of mind be composed, unless of processes representing movements and impressions; and how can the convolutions differ from the inferior centres, except as parts representing *more* intricate co-ordinations of impressions and movements in time and space than they do? Are we to believe that the hemisphere is built on a plan *fundamentally* different from that of the motor tract? What can an "idea," say of a ball, be, except a process representing certain impressions of surface and particular muscular adjustments? What is recollection, but a revivification of such processes which, in the past, have become part of the organism itself? What is delirium, except the *disorderly* revival of sensori-motor processes received in the past? What is a mistake in a word, but a wrong movement, a chorea? Giddiness can be but the temporary loss or disorder of certain relations in space, chiefly made up of muscular feelings. Surely the conclusion is irresistible, that "mental" symptoms from disease of the hemisphere are fundamentally like hemiplegia, chorea, and convulsions, however specially different. They must all be due to lack, or to disorderly development, of sensori-motor processes.

dependent processes being tacked upon others. It is an evolution of the higher out of the lower, of course with additions. The facts supplied by cases of hemiplegia show that *each* part of the corpus striatum "contains" movements of the whole of the face, arm, and leg, although no doubt in each part the muscles of the face, arm, and leg are represented in different degrees, and are grouped in different order. In hemiplegia the loss is of a *certain* number of possible Simultaneous movements of the face, arm, and leg—the sum of a number of possible co-ordinations in Space. Similarly a convulsion on one side is the abrupt development of a certain number of possible Successions of movements of the face, arm, and leg—the sum of a number of possible co-ordinations in Time.

Now palsy results from destruction of *fibres*, and of course the *fewer* the fibres which go to a muscular region from a particular part of the nervous system,* the *more* that region is paralysed by a destroying lesion in that part. In the ascent from the comparatively simple processes of the corpus striatum to the highly complex ones of the convolutions there will necessarily be a great increase of fibres, and hence large destroying lesions in the hemisphere will result in no palsy, whereas palsy will follow lesions equally large in the corpus striatum. But the increase of complexity necessitates many ganglion cells, results in a large supply of explosive matter, and hence excessive discharge, producing severe convulsions, occurs, when this grey matter becomes unstable.

Then it may be said that one convolution will represent only the movements of the arm, another only those of speech, another only those of the leg, and so on. The facts above stated show that this is not the plan of structure of the nervous system. Thus, to take an illustration, the external parts, x, y, and z, are each represented by units of the corpus striatum. But the plan of representation is not that some units contain x largely only, as x_3, others y largely only, as y_3, but that *each* unit contains x, y, and z—some, let us say, as x_3, y_2, z, others as x_2, y_3, z, &c. When we come to the still higher evolution of the cerebrum, we can easily understand that, if the same plan be carried out, a square inch of convolution *may be wanting*, without palsy of the face, arm, and leg, as x, y, and z are represented in

* It is not to be implied that all fibres run direct from the brain to the muscles. No doubt there are series of centres betwixt the convolutions and the muscles they move. Probably some fibres run direct.

other convolutions; and we can also easily understand that *discharge* of a square inch of convolution must put in excessive movement the *whole* region, for it contains processes representing x, y, and z, with grey matter in exact proportion to the degree of complexity. (See quotation from Spencer, page 165.)

Then it may be asked, Why, if the face, arm, and leg *are* represented *together* in the square inch, is the fit a sequence only? Why are not all these parts convulsed contemporaneously?

We are in the habit of considering degrees of range of paralysis —defects of co-ordination in Space—and too little degrees of disorderly succession of movements—disorders of co-ordination in Time. The two co-ordinations are obviously inseparable, but we may for analytical purposes consider each distinctly. Co-ordination in Space —the power of using several muscles together for one purpose—is brought about by groupings of fibres. Co-ordination in Time—the process by which one movement follows another—is brought about by relations betwixt ganglion cells. (See page 203.) There must in health be fixed orders of simultaneous movements, and fixed orders of successions of movements. Not absolutely unalterable, but allowing variations within certain limits only, and in the hemisphere—mental processes being seemingly, but not really, without law—the possible variations will be greater than in parts representing automatic movements, *e.g.*, those of respiration. In disease, the range of paralysis and the sequence of spasm will represent sums of fixed orders of co-ordinations. To take a case in which the convulsions are limited to one side: the spasm affects the forearm, then the upper arm, then the face, then the thigh, and lastly, the foot. Such sequences will represent the sums of the fixed time-relations these regions have to one another in the part of the nervous system discharged. We see the same in the severest fits. The spasm is of the unilateral muscles of the first side, then of the bilateral of both sides, and then of the unilateral muscles of the second side. When records of cases in which the spasm extends to the second side are obtained, the presumption is that sequences will be disclosed, which will show the time-relations of physiological regions of the limbs of one side, to physiological regions of the limbs of the other side: for illustration's sake, such relations as we see in quadrupedal walking.

Then it will be said, How comes it that the bilateral muscles are affected on *both* sides in discharge of the convolutions, when a destroying lesion, even of the corpus striatum, produces no palsy of these

muscles? The usual explanation used to be that these muscles escape in hemiplegia because they are *un*connected with the corpus striatum. Broadbent has advanced an hypothesis which has thrown much light on this and on other points in the physiology of the nervous system. He supposes that the bilateral muscles of both sides, those muscles which must act together, are connected with each of the corpora striata, whilst the unilateral of each side are connected only with their corresponding (opposite) corpus striatum. (For details I must refer to his original paper, "Med. Chir. Rev.," April 1866.) When but one of the corpora striata is *destroyed*, the bilateral muscles of neither side are quite paralysed, because they are governed by the opposite corpus striatum. When one of the corpora striata is *discharged*, or when convolutions discharge through it, the bilateral muscles should be put in action on both sides, if Broadbent's hypothesis be correct. They are put in action on both sides in some cases. The reason they escape in others is simply that the fit is partial. They are always involved at a certain stage of the fit. Parts serving for most varied uses—*e.g.*, the limbs—will be those which are represented not only by most grey matter, but by most unstable grey matter, even in health. In the seizures they are convulsed first. The more automatic parts—*e.g.*, the muscles of respiration—will obviously be represented in the cerebrum by more stable processes than those serving in the more "voluntary" actions. That Broadbent's view is correct I have no doubt, and I presume to have verified it by the observation of cases of hemispasm. (See "Medical Times and Gazette," August 15, 1868; also Case 5, page 176.)

But in severest cases, (see page 166,) the spasm beginning, say, in the right hand, not only affects the unilateral muscles of this side, (I call this the "first side,") and the bilateral of both sides, but next the unilateral of the left side, (I call this the "second side.") But it is to be observed that the unilateral muscles of the second side (left) are affected less in degree, (and I believe more contemporaneously,) and, more important still, *after* those of the first side (right).

It may seem that the last mentioned observations are contradictory to Broadbent's hypothesis. But I think they are at least in harmony with the *principle* of that hypothesis. Broadbent does not make an absolute distinction betwixt bilateral and unilateral movements. At all events I think there can be no doubt that the hypothesis is so far correct as this, that the more muscles of the two

sides act together, the more equally are they represented in the two sides of the brain, and the less they are paralysed on one side from disease of the opposite side of the brain.*

I deduce from these facts that the unilateral muscles of the two sides are represented *fundamentally* on the same plan as the bilateral of the two sides. But whilst the bilateral of both sides are represented in each side of the brain nearly equally in quantity of fibres and cells, and nearly equally in degrees of instability of grey matter, the unilateral of both sides are represented in each side of the brain very unequally in quantity of fibres and cells.

2.—*The functional nature of the change in nerve tissue.*

I will now take it for granted that the fact of the muscles of the face, arm, and leg of one side being first and most affected, shows that there is disease of the opposite side of the brain in the Sylvian region. I say "affected," because so far as *localising* goes, it matters little *how* the muscles are affected—palsied, or in occasional spasm, or in frequent irregular movement. It is the muscular *region* affected which localises—or in other words, it is this which points to the organ damaged. In order to find out the *functional nature* of the damage of nerve tissue thus localised, we have to consider a totally different kind of evidence, *viz.*, the *condition* of the muscles of the region affected.

From the *point of view of function*† there are two ways in which nerve tissue suffers. It may be destroyed, and then there is loss of function. It may be unstable, and then there is disorder of function—discharge.‡ In the case of nervous organs representing movements, we have palsy from destruction and we have irregular

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* In each of two cases of hemiplegia from disease of the pons Varollii now under my care, the chest on the side of the palsy of the limbs does not expand so much as on the other side, but the difference is slight.

† It is perhaps well to remark expressly that the word "functional" is not used in the text in the sense in which it is most frequently used. It is often used to imply a transient change in nerve tissue; and occasionally to imply that the lesion is very trivial, and one that admits of quick restoration. I use it to express what I presume is the real function of nerve tissue, viz., "to store up" and to expend force. It is true that this is the function of all organic matter, but it is *par excellence* the function of nervous matter.

‡ This distinction is, I believe, at the basis of classification of nervous symptoms, whether they be such as hemiplegia and hemispasm, or dementia and mania, or loss of speech and disorder of speech (*e.g.* mistakes in words).

movements (chorea), occasional spasm, &c., from instability. The fit is occasional, because the unstable part requires time to "store up" force for its disorderly discharge, just as healthy nerve tissue requires time to store up force for its orderly discharge. Of course the two conditions may co-exist. Part of a nervous organ may be destroyed, and another part of it may be unstable. Thus we find that limbs partially paralysed are often attacked by spasm. (See Case 8.)

Functional changes must not be confounded with pathological changes, although of course the two necessarily co-exist. I will try to make clear what I mean by this seemingly contradictory statement. Many different pathological processes may lead to destruction, and many different pathological processes may lead to instability. To illustrate by *loss* of function from destruction of a motor organ. It is inaccurate to speak of hemiplegia (the common form of hemiplegia) as a symptom of any kind of pathological change—of cerebral hæmorrhage for instance. It is a symptom signifying *destruction* of the higher motor tract *however produced*, by clot, softening, tumour, laceration, &c. We find essentially the same kind of hemiplegia from these several destroying lesions—the face, arm, and leg are palsied on one side. Similarly, it is inexact to say that the hemispasm in Case 7 depends on syphilitic disease of the brain. It does so depend in one sense, but, methodically speaking, spasm depends on instability of nerve tissue, and this instability may attend any kind of lump, syphilitic or not, and may indeed occur from causes altogether different. I have seen unilateral convulsion in a case of meningeal apoplexy, and with syphilitic nodules in the cerebral hemisphere; I have seen it following hemiplegia, the supposed result of embolism; and I have seen it following blows on the head. And no doubt instability results from pathological processes which we cannot detect. So if I am told that hemispasm is "only a symptom," and may depend on "many causes," I admit it in the sense that various pathological processes may lead to that instability of nerve tissue which permits an occasional excessive discharge on muscles; but *from the point of view of function* there is but one cause of convulsion, *viz.*, instability of nerve tissue. Of course there will be varieties of range of convulsion, degrees of instability, degrees of quantity of nerve tissue unstable, and, more important than all, degrees of evolution of the nervous processes (nearer to and further from the motor tract) which the pathological change renders unstable.

So far then I have concluded—

1st, That convulsions beginning unilaterally point to disease of the opposite hemisphere.

2ndly, That the spasm depends on changes of instability there seated.

Now we come to consider the several kinds of pathological processes by which such local instability may be brought about.

3.—*The pathological processes.*

I confess that in most cases we cannot conclude.

In Case 1, and in Case 2, I have not a particle of evidence to show what the pathological process may be. We need rarely be at a loss for the "cause" of a fit if we are satisfied with attributing the seizure to the nearest unusual circumstances in the patient's medical history, especially to the so-called causes to be mentioned under No. 4.

There are but two pathological processes which lead to the local instability above mentioned, of which I can speak with any confidence, *viz.*, (*a*) changes produced by embolism, and (*b*) changes diffused from coarse disease.

(*a*) *Embolism.*—It is not very uncommon to find when a patient has recovered or is recovering from hemiplegia, the result of embolism of the middle cerebral artery, or of some branch of this vessel, that he is attacked by convulsion beginning in some part of the paralysed region, almost always, I believe, the face or the hand. I have not, however, yet made a *post-mortem* examination on a patient whom I knew to have had fits *of this kind* after supposed embolism. It will be safer, then, to say that such seizures occur in patients who have recovered partially, or seemingly entirely, from hemiplegia occurring with heart disease, or with the parturient state. And as I have made no *post-mortem* examination in any such case I will not relate any cases in illustration. I have recorded several cases of the kind in a paper on "Loss of Speech," in the first volume of the London Hospital Reports, 1864.*

Dr. John W. Ogle and Dr. Murchison have drawn attention

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* I think it very likely that in some cases of convulsion after embolism we should find *post-mortem* aneurism of a branch of the middle cerebral artery. The autopsies I have had in cases of death by rupture of aneurisms of large cerebral vessels, tend to confirm the view Dr. John W. Ogle has put forward as to the causation of aneurism by embolism. For facts in support of this view, see Dr. Church's admirable paper, "Contributions to Cerebral Pathology," St. Barth. Hosp. Reports, 1869.

to the fact that aneurisms of the larger cerebral vessels have been found in patients who have been subject to "epilepsy," that is, to chronic convulsive seizures before the fatal one due to rupture of the aneurism. Mr. Callender ("St. Barth. Hosp. Rep., 1867, vol. III., page 426,) has made the very important observation that "the epileptic attacks belong to aneurism of the middle cerebral artery." I have, in the volume above referred to, spoken of the significance of the fact of aneurism of the middle cerebral artery being attended by fits. But I know of no case on record in which the particular kind of fit has been described. I surmise that in these cases the convulsion begins on one side, but I have, I repeat, no facts on the matter.

I do not think as I then did (1864) that the *persistent* condition of nerve tissue on which the fits depend results from diminished supply of blood to healthy nerve tissue in this vascular region.* Plugging of small branches of the middle cerebral artery leads to congestion, and thus to over-nutrition, and consequent instability of the convolutions (and possibly of the grey matter of the corpus striatum). It is admitted that plugging of *small* arteries does lead to increased quantity of blood in the part to which the plugged arteries belong. Plugging of a large branch leads to softening and destruction, and consequently to palsy, but even in these cases we occasionally find also congestion† of parts of the convolutions and sometimes minute extravasations.

The occurrence of unilateral convulsions with conditions implying plugging of the middle cerebral artery is interesting as regards the *seat* of the changes producing or allowing this variety of convulsions.

(*b*) *Coarse Disease.*—I had prepared here remarks intended to show how we arrive at the conclusion that the convulsion is the result of changes of instability produced by a foreign body—by coarse disease. But I omit them, since they would be a digression. We

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* *Sudden diminution* of the supply of blood to a large tract of grey matter, as when the middle cerebral artery is plugged, will cause convulsion. Hemiplegia from plugging of the middle cerebral artery does not always come on suddenly, and then there is no convulsion, and probably convulsion does not occur when the vessel plugged is small.

† I have considered this subject ("Medical Times and Gazette," March 6th, 1869) in relation to the pathology of chorea, which symptom I suppose *most often* depends on changes produced by blocking *small* arteries in the region of the corpus striatum.

may say generally that the symptoms are such as severe headache, in unusual places; urgent, purposeless, and perhaps bilious vomiting; and double optic neuritis. This remark requires careful qualification, which space will not allow me to give. The symptoms mentioned merely point to the inference that there is a lump of something—a "foreign body," "coarse disease," (foot-note, page 178)—inside the head. They give no information as to its locality, whether for instance it be in the cerebrum or cerebellum, and no information as to its particular pathological nature, *e.g.*, whether it be a glioma or a syphilitic nodule.

I will suppose that we have arrived, in a particular case, (see Case 7,) at the following inferences.

(1.) Disease of the Sylvian region of one cerebral hemisphere, because the muscular region affected was the face, arm, and leg of the opposite side.

(2.) That the disease is instability of the grey matter there situated, because the motor symptoms were *occasional spasm.*

(3.) That the instability is the result of changes spreading from "foreign bodies" there placed, because the patient has had violent headache, &c.

Still, we have to find out what is the pathological nature of the foreign body. Is it glioma, syphilis, &c.? I can only glance at this part of the question. It is admitted that it may be of any kind, but it so happens that in nearly all the chronic cases on which I have had autopsies, the examination has revealed *syphilitic* disease of the hemisphere. The foreign body has been a syphilitic nodule. Indeed in most cases when this kind of convulsion is associated with *double* optic neuritis, there has been clear evidence of syphilis. These two symptoms are not decisive evidence of syphilitic disease within the cranium, but are at least warrant for the administration of iodide of potassium in large doses. ("Medical Times," May 23, 1868.)

I have published three cases of this kind in the London Hospital Reports, Vol. IV. In one of those cases, subsequent to the publication of the volume, I made an autopsy, and found syphilitic disease of each cerebral hemisphere. It may be said, then, that the optic neuritis and the unilateral spasm depended on disease of *both* hemispheres. But the following is a report of a case in which but one hemisphere was diseased.

I have a very lengthy account of the case, but the following brief note, which appeared in the "Lancet," October 24, 1868, will

suffice for my present purpose. I have recently made an autopsy on a man who had been under my care for several years with like symptoms. In his case there was syphilitic disease of the lower part of the ascending frontal and ascending parietal convolutions of the right hemisphere, but there was disease of the left hemisphere also.

Case 7. Convulsions beginning in the left hand. Double optic neuritis. Syphilitic disease of the opposite hemisphere.

A man aged twenty-four was admitted in January, 1868, for convulsive seizures, each of which began in the left hand. After each severe fit he was weak on the left side. His sight was apparently good; but his field of vision was not tested. Nevertheless, he had double optic neuritis (descending).* His eyes were examined by several good ophthalmoscopists (Brudenel Carter, Soelberg Wells, and Clifford Allbutt of Leeds). The patient had also severe pain in the head. Now the disorder of the unilateral muscular region and the "epileptic hemiplegia" showed plainly, Dr. Hughlings Jackson believed, that there were pathological changes in the corresponding cerebral hemisphere. The pain in the head and the optic neuritis showed that the local internal disease was "coarse," and the subsequent cropping up of a node on the right side of the head declared that the "coarse" disease was syphilitic. The fits continued at irregular intervals, and, besides, the muscles of the affected arm were the seat of a great variety of abnormal movements. It is important to observe that, after one severe fit, the right third nerve was palsied. The patient's sight failed a few

* It will have struck clinical observers, and perhaps puzzled non-medical psychologists, that blindness often and deafness never attends disease of the cerebral hemisphere. We cannot suppose that the auditory nerves do not reach the cerebral hemisphere while the optic nerves do. No doubt the auditory and the optic nerves are represented in every part of it—not directly, but in *combination* for movements of speech, sight, &c. The fact is that no kind of disease of the cerebral hemisphere causes blindness. I mean that mere destruction of large parts of the hemisphere does not cause blindness nor even defect of sight. Indeed (see foot-note, page 186) it need not cause any symptoms at all. Coarse disease therein leads to changes in the optic nerves on which blindness may or *may not* follow. The patient (Case 7) had no defect of sight when his optic nerves were inflamed. My speculation is that optic neuritis occurs, not because a part of the hemisphere is *destroyed*, but because a "foreign body" therein—especially when, as in Case 7, grey matter is largely involved—leads to frequent contractions and relaxations of arterial branches supplying the optic nerves. (See "Medical Times and Gazette," April 30, 1864.) It has long

weeks before his death (August 29th), and on the 8th of August the eyes presented the appearances of the "swollen" disc. As was easily inferrible during the patient's life, there was found at the autopsy a syphilitic mass, or rather a cluster of syphilitic nodules, growing from the dura mater, and seemingly pressing the pia mater before it into the right cerebral hemisphere. Iodide of potassium was given in large doses—ten and twenty grains—but did little good. The bromide was also given.

Although as a matter of fact the gross disease is most often syphilitic, it may be of any gross kind. In the following case the disease was possibly an abscess. This case was published in the Royal London Ophthalmic Hospital Reports. (Vol. V. part I.)

Case 8. *Injury to the right side of the head. Convulsions and hemiplegia of the left side of the body.*

I first saw this patient when he was in St. Bartholomew's Hospital, under the care of Mr. Paget. By Mr. Paget's permission, the man was afterwards under my care at the Hospital for the Epileptic and Paralysed.

A man, now (1865) twenty-three years of age, was struck on the head, December 3rd, 1863, by a shovel; the immediate result was a scalp wound, for which he was kept in a hospital in New York, fourteen days, and was then discharged apparently well. A week later he began to be giddy, rambled about and talked nonsense, and was supposed to be going out of his mind. His head swelled, and he was told at the hospital that he had a "puffy tumour" on the right side of his head. He became comatose; and on January 3rd,

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been observed that blindness attends tumours of the hemisphere. It very rarely—never in my experience—attends softening from embolism. It thus contrasts very strikingly with loss of speech which is caused by destruction of brain structure by any kind of pathological changes. When the lesion is clot this may, some time *after* causing loss of speech in its character as a destroying agent, lead to optic neuritis in its character as a "foreign body." The optic nerves have direct nutritive relations, but very indirect functional relations, with the hemispheres. The auditory nerves have not, so far as we can judge by the distribution of arteries, direct nutritive relations with the cerebral hemisphere. It is also a significant fact that disease of (a foreign body in) *one* hemisphere can affect *both* optic nerves. It has not, however, a significance of the same kind as the fact that disease of but *one* hemisphere causes loss of speech.

These remarks are not really a digression, as the inference is strong that optic neuritis, and the changes on which convulsion, irregular pulse, &c., occurring with coarse disease of the brain, depend, are all really changes of the same kind. (See "Medical Times and Gazette," August 15, 1868.)

was trephined. He was afterwards told that this was done on the supposition that there was an abscess "pressing on the brain," and that at the operation "four or five ounces of matter were let out." He did not recover his senses, he says, until March 4th.

[Here, out of order, I may state, to have done with the description of the organic disease, that there is now wanting a large tract of bone on the right side of the skull, (4in. by 4in.,) part of the frontal, part of the occipital, and nearly all the parietal bone. See plate 1.]

The first fit, or at least the first of which he knows anything, occurred on March 14th, one hundred and one days after the injury, eighty days after the trephining, and ten days after recovering consciousness. The fit began in the fingers of the left hand, and it gradually ran up the arm, missed the neck, and affected the face. The face was drawn. After this he became insensible, and found on recovery that he had bitten his tongue on the left side. He was told that the fit lasted only two minutes; he did not sleep after it, and in half an hour felt well, except that the arm and leg were weak, and they have been so ever since. He had in fourteen days a series of five fits, and for some time four or five at a time, about every fourteen days. At the end of about five such periods he had no more, until an operation on August 20th. The bone came away on August 3rd, and on the 20th, an unsuccessful attempt was made to bring the skin over the gap. He then had three fits. Since they have been much less frequent.

They all begin in the same way, *viz.*, in the hand, and sometimes can be stopped by the ligature. The arm is now decidedly paralysed. He can *move* it, but he cannot *use* it for any purpose. The left leg is weaker than the other, but only slightly so. (*Vide infra.*)

This patient has atrophy of each optic disc; they are now pretty well margined, but there is slight irregularity at their edge, which makes me conclude that the condition of atrophy has followed neuritis. It is the condition into which neuritis ultimately passes. The vessels are not very much diminished in size. There is no loss of smell, and the patient is very intelligent. So long as he takes the bromide, so long is he free from fits.

To the time of the above report from the "Ophthalmic Journal" the patient was only partially paralysed. On March 3rd, 1866, he was struck on the head, and the same night or next day he became absolutely paralysed of the left side, and to this time—January 1870 —the arm is quite motionless and rigid. He can walk, but for all

PLATE I.

CASE 8.—LOSS OF CRANIAL BONES.

that the leg is absolutely paralysed. He walks by swinging the leg from the hip—the muscles from the trunk to the leg only having much power. This happens more frequently than would be supposed. A patient may walk when he cannot move his toes, nor his foot, nor his leg at the knee. A patient may say he has got the use of his leg, when we find on examination that he has only regained power in the muscles from the trunk to the leg. The leg gets stiff, and the limb is not so much a muscular apparatus as a stiff crutch. But the point of interest with regard to my present subject is that the patient has had no severe fits since he was completely paralysed, although he has since taken no bromide. The only thing is, that when he is startled he has what he calls "drawings to the left." He shows me that his head and shoulder give a little twist to that side. These attacks are only momentary. He is now, although more paralysed, in a much better condition than before. I suppose the unstable part of his hemisphere which used to discharge has become somehow destroyed since the accident, and can discharge no longer.*

Dr. Pagenstecher, who was at the hospital the day this patient attended, made an ophthalmoscopic examination, and agreed with me that there was atrophy of *both* optic nerves.

Cases 7 and 8 give still further proof that the seat of the disease in these seizures is the region of the corpus striatum. Although embolism, which I suppose to lead to this kind of convulsion, is a different pathological process from that which occurs in Cases 7 and 8, the result is the same, *viz.*, instability of nervous tissue in the region of the corpus striatum. We now come to the

4.—*Circumstances which determine the paroxysm.*

Many things may discharge nerve tissue, *viz.*, tearing up by blood clot, bleeding to death, and, as is supposed, poisonous conditions of the blood, *e.g.*, uræmia. But I speak here only of chronic cases in which there is a persistent local lesion and an occasional discharge.

I think, as I have before remarked, that there are two factors in

* Since the whole of this paper was in type I have learned from Mr. Bloxam of St. Bartholomew's, that the patient was admitted into that hospital, March 8, 1870, and that he died there, March 17. He had been injured by a fall while intoxicated ten days before admission. Subsequently hernia cerebri occurred. Mr. Bloxam intends to publish details of a careful examination of the brain, but it will suffice for my present purpose to say that—as indeed was evident *ante-mortem*—there was found *post-mortem* disease of the surface of the right cerebral hemisphere in the region of the Sylvian artery. There was universal meningitis as well—most marked at the base and in the Sylvian fissure.

the production of a paroxysm—1st, Permanent local instability; 2ndly, Something which determines the discharge of the part unstable.

The part unstable "stores up" force, and when it reaches a certain degree of instability discharge of it is easily provoked. It may be that when by continuous nutrition it has risen to a certain degree of instability—it explodes, either "spontaneously," or in some normal periodical change in the body, or in some abnormal disturbance, the result for instance of fright or of flatulence. (See Case 4. For an account of the researches of M. Spring, on healthy periodicity, see "Lancet," May 22, 1869). It falls then to a state of stable equilibrium, and once more by continuous nutrition rises to its former undue instability, when another explosion can occur. It is in short an exaltation of ordinary nutrition and function. I suppose that the provoking agents may be various—that many things will upset the equilibrium of the highly unstable nerve tissue.

We may say of all nerve tissue, healthy and diseased, that it acquires by nutrition a condition of unstable equilibrium,* but discharge in health is a consequence of excitations which are *special.* The discharge of a *highly unstable* patch in disease may, I believe, be brought about by very *general* excitations. This is, I presume, the belief of those who attribute fits to excitement, flatulence, &c. (See Case 4.) All these general causes, I presume, act by altering the circulation in the head, during which alteration the equilibrium of the unstable patch is upset. I suppose this must be the explanation of the effect which dyspepsia, fright, &c., have in "causing" convulsion limited to one side. They can only alter the bodily condition generally. They cannot, at least, pick out one side of the brain. They must affect both its sides equally, and yet the equilibrium of the side diseased only will be upset, because on that side only is there nerve tissue which is in a condition to explode on slight and general provocation. I believe such general conditions are only exciting causes of the paroxysm—that they only determine the beginning of the discharge, which when begun leads to further and further discharges in the vascular region in which the unstable

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* Here I would refer the reader to Mr. Paget's paper "On the Chronometry of Life," read at the Royal Institution, April 8, 1859. The statements in the text appear to me to be an application of his doctrines on the time regulated processes of health to the explanation of disorder of time-regulated processes in disease.

nerve tissue lies. I can, however, only state the speculation on this matter in merest outline, as I have many times written on this subject elsewhere.

The usually accepted theory of the production of the paroxysm is that it is determined by contraction of arteries. (Brown-Séquard.) I have advanced the speculation that certain symptoms—*e.g.* optic neuritis, "cerebral fever"—follow the order of arterial regions, and that the *liability* to the convulsions which I have described in this paper—those at least beginning in the hand—is due to persistent changes in the region of the middle cerebral artery, and that the *paroxysm* itself is owing to a *local* vascular contraction.

It seems to me that the development of simultaneous movements and of movements in succession must depend on different processes both in health and in disease. As before said, (page 191,) the separation here made is to a large extent artificial. It is, I think, of great importance to distinguish the two kinds of co-ordination. It will not, at all events, suffice to speak of co-ordination as a separate "faculty." Co-ordination is the function of the whole and of every part of the nervous system. And although each part co-ordinates different impressions in different time-relations, no doubt the process in every part is fundamentally the same—in breathing, walking, and thinking. We are, I think, studying co-ordination in its simplest aspects when we work at regional palsy and sequence of spasm. The following is speculative, but may be of some value in suggesting lines of investigation.

Simultaneous movements are brought about by combinations of fibres and cells. Successions of different movements are developed by contraction of arteries. *Repetitions* of movements may be owing to repeated discharges of the *same* nervous process. But when one movement follows a different movement automatically, the discharge of the nervous process for the first movement develops the second movement by fibres to the vessels supplying the nervous process for that second movement.

I take it for granted that the arteries are arranged on some plan, or orderly nutrition would be impossible. I suppose the irritation of "coarse" disease in an arterial region produces abnormal and persistent changes of nutrition in the region of that artery, by frequent contractions and consequent relaxations of its branches; changes in convolutions, from which convulsions may result; and optic neuritis, from which blindness may result. A convulsive paroxysm is developed by a stronger and more con-

tinued contraction of the same branches, and one which probably spreads to branches supplying healthy nerve tissue. It is, I speculate through the arteries that sequence of movements is developed, whether those movements be spasm passing up the arm and down the leg, or whether they be the orderly sequences of movements in health.

In concluding this paper I wish particularly to refer to important observations on "Hemiplegic Epilepsy," by Dr. Russell of Birmingham. "British Medical Journal," June 22, 1867.

POINTS TO BE OBSERVED IN OVARIOTOMY.

By D. Lloyd Roberts, M.D., M.R.C.P. Lond., Physician to St. Mary's Hospital, Manchester.

Although it is generally conceded that ovariotomy was suggested or advocated by Plater, Diermerbroeck, Vanderhaar, Delaporte, Morand, William Hunter, and John Bell, yet it must be admitted that the first authentic recorded case of removal of diseased ovary occurred in the practice of Dr. McDowall, of the United States, in 1809. The instances reported anterior to this date are so vaguely described, and so wanting in trustworthy detail, that no ovariotomist now seriously attaches any value to the cases of L'Aumonier and Dzondi. It is, however, certain that the practice of removing or destroying the ovaries was practised by various nations, for other than medical purposes. "Isbrand de Diermerbroeck relates that Adrometes according to Athenæus, and Gyges according to Suidas, both kings of Lydia, had recourse to the practice of extirpating the ovaries, on women of their kingdom, with the view of making them barren. According to some authors, this custom, as barbarous as it is immoral, existed in a like manner among the Egyptians and some other oriental people." Again, "Jean Weir, who died in 1588, relates that a sow gelder, suspecting the virtue of his daughter, opened her abdomen, drew out the uterus, and cut out the ovaries. The same author adds that this cruel operation was attended with complete success."*

Dr. Roberts testifies that, "being in the vicinity of Bombay, in 1841, he had an opportunity of examining three female eunuchs, called Hedjera, and that, according to the account of an old Brahmin, the atrophy of the ovaries was effected by puncturing them with needles impregnated with the juice of the unripe thelpheut (?)"†

* "Traité complet des Maladies des Femmes," par Colombat de l'Isère, t. ii., p. 854. Paris, 1843.

† Quoted by Tilt, "Uterine and Ovarian Inflammation," page 62. London, 1862.

Although the operation, after its performance by McDowall, was not unfrequently had recourse to, it is within the last ten years only that it has become generally recognised as one of the legitimate operations of surgery. Its opponents were numerous, and armed with the weight of authority. Velpeau said that it was "an operation which was on no account to be admitted into French surgery." Dr. Haen designated it as an "operation of which it would not do to talk, lest some reckless surgeon should attempt its performance." Scanzoni averred that "it would be a proof of madness in the patient who should adopt it, and of crime in the surgeon who should abet such a mode of suicide." Colombat remarks that "it is an operation not to be justified by the most fortunate issue, in any ratio whatever, of the cases." Liston stigmatized it as "belly-ripping." Other authorities manifested towards this innovation similar trenchant hostility.

Notwithstanding these severe condemnations the operation has found not only advocates, but willing and successful operators; and the names of McDowall, Lizars, Jeffreson, West, Clay, Walne, Bird, and Atlee, will always be associated with its early introduction. With this brief notice of the struggle of ovariotomy into surgical recognition I propose to indicate a few points necessary to be observed in its performance.

Season of the Year.—Since the reading of this paper, our distinguished President, Dr. Richardson, has published a lecture in the "Medical Times and Gazette,"* which contains observations of the utmost value regarding the influence of the season of the year, and external atmospherical influences, on the success of formidable surgical operations. From a return, furnished by Mr. Wells, of the ovariotomy cases performed by that gentleman, during an entire year, Dr. Richardson shows that, in the first quarter, the proportion of deaths was 1 in 5·3; in the second quarter, 1 in 13; in the third quarter, 1 in 5; in the fourth quarter, 1 in 1·8. It would thus appear that the second quarter is the most favourable, and the last quarter the least favourable, to the performance of ovariotomy; and, doubtless, this applies to all formidable surgical operations. It behoves anyone about to undertake a case of ovariotomy to ponder well over this lecture.

Position of the Patient.—The supine posture is not only that most commonly recommended, but where chloroform is administered it is

* January 29, 1870.

the safest. Dr. Tyler Smith and some other ovariotomists prefer to seat the patient in a chair, believing that this position favours the passage of fluid out of the peritoneal cavity and causes the tumour or cysts to project more towards the surface, thus facilitating their removal. In the case of a single cyst where the opening in the parietes is not large I have seen this position attended with very great advantage ; but where the tumour is solid, multilocular, and adherent, requiring a larger incision in the parietes, I think this position by favouring protrusion of the bowels—an untoward event—is objectionable ; as any disturbance of the intestines is liable to produce vomiting, peritonitis, &c. The side position as recommended by Hutchinson, seems to serve the important purposes of more easily drawing out the cysts and of facilitating the removal of fluid, coagula, &c. ; moreover it is not open to the disadvantages just referred to.

Operating Room.—All operations involving abdominal section should be performed in a room, light, airy, lofty, and free from draughts. In hospitals a ward should be exclusively appropriated to ovariotomy. The walls should be painted, or, better still, covered with Parian cement, to admit of frequent washings, and to obviate to the utmost extent the absorption of putrid effluvia, and the consequent risk of pyæmia or surgical fever. For the same reason the ward should contain as little furniture as possible. In short, every available precaution should be taken to avoid an unhealthy atmosphere, a condition well known to be eminently noxious to the subjects of abdominal operations.

The Operating Table should be opposite and near a window. The patient should be well and completely covered with flannel for warmth, only the abdomen and face being exposed. The bed, thoroughly warmed, should be at hand to receive the patient ; and she should be lifted into it with the utmost care, as the slightest shaking is liable to bring on vomiting.

Temperature of the Room.—The high temperature advocated by the earlier operators is wholly unnecessary, and even injurious, as it increases the risk of chloroform accidents. A temperature of 64° I have found most favourable.

Anæsthetics.—I have invariably used chloroform. From its tendency to excite vomiting, that very formidable complication in all abdominal sections, it is highly important that the patient should be brought and maintained under its influence by as small a quantity as possible. This is the primary object to be kept in view ; and

whatever the apparatus used, careful and experienced administration is essential. Mr. Spencer Wells informs me that for the last two years he has used methylene in preference to chloroform. Dr. Keith has employed sulphuric ether, and the very little vomiting which resulted, added to the success of his operations, appears to constitute a strong recommendation in favour of that anæsthetic. Æther spray I have not used in any case of ovariotomy, but I have employed it in a case of Cæsarian section.* Although during the operation the woman complained of little pain, and the success of the process as an anæsthetic was undoubted, still vomiting, for the avoidance of which the spray was employed, formed one of the most harassing and dangerous symptoms following the operation.

Incision.—Considerable difference of opinion existed among the earlier operators upon this point. It may now be regarded as established, that the extent of the incision should be determined, not only by the size, but also by the nature and consistence of the tumour, the small incision being first practised, and afterwards enlarged according to the necessity of the case. When the contents of the tumour are fluid they can be drawn off easily by the canula ; the cyst, thus diminished in size, following by the slightest traction through a comparatively small incision. On the other hand, if the tumour is solid and does not admit of reduction, it is better to enlarge the incision than violently to drag a solid resisting mass through an opening wholly inadequate for the purpose. The extent to which compound cystic tumours may be reduced by the method adopted by Mr. Wells, in emptying one cyst through another by the trocar, is surprising. In making the superficial incision it is well to avoid opening the peritoneum until quite sure there are no bleeding vessels, which should be twisted or tied. The incision should be made down to the peritoneum without a director. This membrane can then be pinched with the forceps, the fold thus produced divided with the knife, and the director inserted. The membrane can then be divided upon it, above and below, till the incision is co-extensive with that in the abdominal wall. This first incision may extend to two inches above the pubes.

Adhesions.—Before tapping the cyst the hand should be passed through the incision and over the tumour, to ascertain if there are any adhesions. If these exist, they may be separated by the hand, by the handle of the scalpel, or even by dissection. Adhesions to the

* Obstetrical Transactions. Vol. IX., page 250. London.

bladder, liver, intestines, omentum, and abdominal parietes, are dangerous in the order enumerated. The separation of adhesions to the liver, intestines, or bladder, is better effected by careful dissection, great care being necessary in order to avoid denuding the viscus of its peritoneal coat or perforating the intestine.* Bleeding vessels are best treated by the actual cautery, or more safely by ligature, cutting the ends close.

Pedicle.—Whatever method of dealing with the pedicle is adopted, the cardinal object is always the prevention of hæmorrhage. Unfortunately, the means most effectual for attaining this end are not the most favourable for promoting the recovery of the patient. The ligature, the most obvious as well as the most trustworthy method of stopping bleeding from open vessels, is necessarily attended, during the process of separation, by suppuration into a serous cavity, a condition involving great risk to the patient, and constituting a formidable drawback to its employment. Although this evil appears to have been to some extent obviated by cutting the ligature close to the pedicle, further experience is needed to prove that there is not some danger even under these circumstances.

There are now various methods of treating the pedicle, viz., by clamp, ligature, actual cautery, écraseur, pocketing the pedicle (Storer), and the seroso-plastic method (Maslowsky), each possessing peculiar advantages according to the nature of the case. When the pedicle is sufficiently long, and not very broad, and can be brought externally without undue traction on the uterus, the clamp, as first used by Mr. Hutchinson, and afterwards more extensively by Mr. Spencer Wells, offers the best method of treatment, as all suppuration into the abdomen and pelvis is avoided, and the risk of septicæmia, etc., diminished.

The objections to the use of the clamp are, that in the event of distension of the intestine taking place, a portion may become strangulated, and so cause death. Another objection, urged by some, is the possible dragging upon the uterus, causing vomiting and

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* In June 1866, I operated upon a lady, a patient of my friend Mr. Heslop, where the adhesions, both visceral and parietal, were very extensive. On the fifteenth day a portion of intestine opposite the lower part of the wound gave way, and fœcal matter passed continuously through the wound for some weeks. The perforated intestine, however, eventually healed, and a good recovery resulted. This interesting case I hope to publish along with another, in each of which pregnancy subsequently occurred.

serious symptoms of collapse. A third, is the inconvenient and very likely event of the fallopian tube remaining patent some months, menstrual fluid escaping, which is believed to occur in about a third of the cases operated upon. On the other hand, Mr. Wells thinks that this occurrence may prevent hæmatocele; for if menstrual fluid can pass through the fallopian tube, where the stump of the pedicle is fixed in the healed abdominal wound, this may take place when it is dropped into the pelvis. Experience proves that the fixation of the pedicle to the abdominal wall presents no obstacle in the event of future pregnancy and labour.

Whether the pedicle is long or short, the ligature is applicable in all cases. The practice, however, of tying the pedicle, bringing the ends of the ligature externally, and allowing it to slough its way through, is not only tedious,* but involves the risk of pyæmia, pelvic and peritoneal mischief. To obviate these inconveniences Dr. Tyler Smith has revived the bold and ingenious practice of ligaturing the pedicle, cutting the ends close, returning it into the abdomen, and closing the wound; and in his hands this treatment has been most successful. The objection urged against the use of the ligature is, that the presence of a foreign body in the peritoneal cavity is a frequent source of inflammation, formation of matter in the pelvis, and consequent risk of septicæmia; and this is much more liable to occur when the ends of the ligatures surrounding the pedicle are brought out externally through the abdominal wound. This objection does not apply to the same extent when the ligatures are cut short, and the pedicle returned into the pelvis.

Advocates of the use of the cautery support it on the supposition, that, if returned into the abdomen, the ligature may prove a source of irritation; and this plan has also proved very successful in the practice of Mr. Brown, Sköldberg, and others. It is most applicable to short, thick pedicles, where there is little adipose tissue, and the vessels are of small calibre.

Cleansing the Abdominal Cavity.—This should be done with sponges, of moderate size, warm, soft, and perfectly clean. The

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* In two of my cases treated by ligature, the ends being brought out externally, and the pedicle being passed through and secured in the abdominal wound, recovery was delayed simply by the tardy separation of the ligature, the cure in every other respect being complete. In one case in St. Mary's Hospital, the ligature separated on the twenty-ninth day; in another instance, on the thirtieth day.

viscera should be disturbed as little as possible; but it is very desirable that all clots and fluid matter should be removed.

Bringing the Wound together.—This may be done by means of pins, silk, or silver wire; in my opinion, silver wire is preferable, as it keeps the parts in better apposition, produces less irritation, and, if necessary, can be kept in longer than pins or silk. The peritoneum should be included in the ligatures, and there should be three sutures to an inch of surface.

Dressing the Wound.—The wound should be still further supported with crossings of plaster, over which a layer of cotton wool should be placed. There is no necessity for a supporting bandage, as in many cases it produces a great deal of discomfort, is very apt to become displaced, and prevents a ready examination of the wound.

The After-Treatment should be conducted on general principles. The recumbent posture must be rigidly enforced until all danger has passed away.* For the first forty-eight hours the patient should have as little food as possible, so as to obviate the tendency to sickness or vomiting. The food, of a fluid and bland character, such as toast-water, milk-and-water, &c., should be given in small quantities. Pain, restlessness, and vomiting are best controlled by opium, given by the rectum, in moderate doses. The routine practice of giving opium after ovariotomy is now not merely abandoned, but even condemned. I have ceased to administer it in the absence of pain or other symptoms indicating its use. If the patient goes on well for three or four days she may be allowed a little light food, such as chicken-broth, beef-tea, sago-pudding, and good coffee, with milk and dry toast; a little champagne or good sherry, with water, may also be permitted. The bowels should be relieved about the fifth day, by enema, to be repeated afterwards every other day. The periodical use of the catheter should be enjoined, every four hours, the first few days after operation. The ligatures may be removed about

* The necessity of this precaution was strongly impressed upon my mind by a case which occurred to me in April, 1862. I had operated upon a lady, a patient of my friend Mr. James Stephens, and removed a large multilocular ovarian tumour. All went on satisfactorily until the fifth day, when the patient had the imprudence to sit up in bed, and in that position to wash her hands and face, and take her breakfast. On lying down she felt fatigued, and on our arrival the same morning we found her with a fluttering pulse and symptoms of collapse; she sank rapidly on the afternoon of the same day.

the fifth or sixth day. A patient who has undergone this operation should be provided with a day and night nurse; and in hospitals the nurse should have nothing to do with the dressing of other cases.

Formation of Matter in Peritoneal Cavity and Douglas's Space.—In the event of the formation of matter from the retention of fluids in these positions, as evidenced by typhoid symptoms, abdominal distension, pain on pressure, stupor and dizziness, the lower part of the abdominal wound should be opened, a glass tube—or one of Chassaignac's drainage-tubes—should be introduced, to allow the escape of the accumulated fluid; or, with a syringe having a long flexible tube, the abdominal cavity may be washed out once or twice daily with warm water, or, better still, with artificial serum,* as suggested and successfully practised by Dr. Peaslee,† the fluid being allowed to drain off through the tube.

Douglas's Space should be examined *per vaginam*, and if any fluctuation is detected, a trochar should be plunged into the most dependent part, and the fluid allowed to flow through the canula, which must be retained *in sitû*; or, as long as any fluid escapes, the aperture may be kept patent by a drainage-tube.

Sinking or Collapse.—When the patient, whether from urgent vomiting, symptoms of collapse supervening, or any other cause, is unable to swallow, nutriment and stimulants must be regularly and vigorously administered *per rectum*. In the report of a case of ovariotomy published in the "Dublin Quarterly Journal of Medical Science," for February, 1861, I drew the attention of the profession to the remarkable extent to which these restoratives can be absorbed by this channel.

* Composed of water O iv., albumen ʒ vj., common salt ℥ iv.

† "American Journal of Medical Sciences," January, 1856, p. 52.

PRURIGO AND PEDICULOSIS OR PHTHEIRIASIS, AND THEIR CONNECTION WITH PEDICULI.

By Tilbury Fox, M.D. Lond., M.R.C.P.,

Fellow of University College, Physician to the Skin Department of University College Hospital.

I am anxious to point out several errors which are made by writers on dermatological subjects, in reference to the direct connection which is supposed to exist between the presence of pediculi upon the body, and the occurrence of various eruptions—particularly "prurigo"—as a consequence of the irritation and injury to the skin to which pediculi are said to give rise. If we compare the descriptions of "prurigo" which are found in the works of foreign and English authors, we shall not fail to note a great difference of opinion expressed as to the cause of "prurigo," and the part that pediculi are said to play in its genesis. It is strange that this should be the case with so common a disease, and one so thoroughly open to the observation of the physician; but it is easily to be explained by the careless and superficial manner in which cutaneous pathology has hitherto been studied. Scarcely a single dermatologist has taken the trouble to ascertain for himself the structure and habits of the pediculus, with a view to the determination of the probable kind and degree of injury it would be likely to inflict; whether it be possible to discover any characteristic lesion which is produced by the attack of the pediculus; or lastly, to separate out *accidental* from *essential* phenomena. The result is that many observers at the present time, and especially those who are foremost in declaring for the pedicular origin of all cases of "prurigo," are exhibiting not only very considerable ignorance of the anatomy of the pediculus, but a laxity of most ordinary care in observation of common cutaneous phenomena.

I may as well say at once that I admit the presence of pediculi in the majority of the so called "prurigos" which we meet with in hospital practice,—that is amongst the lower orders. But I do not

believe that pediculi are always the cause of skin affections in which there is primarily severe itching or formication, with co-existent papular eruption, the apices of whose papulæ are covered by an hæmorrhagic scale (pruriginous). I hold that different conditions have been and are classed together under the term "prurigo," and that pediculi give rise to certain definite lesions which often complicate "true prurigo," as defined by Willan. And over and above the production of this characteristic lesion they act—that is additionally—after the manner of local irritants in general, and hence may induce many secondary eruptions—such as eczema, ecthyma, and urticaria—or aggravate existing ones. In order that I may make myself clearly understood, I had better sketch the prevailing opinions on the subject of "prurigo."

Most of the profession in our own country still hold to Willan's views, and affirm the existence of three varieties of prurigo, in each of which intense itching and the development of papules having presently a black speck at their apices, (caused by the drying of blood effused by scratching,) are present in greater or less extent, and constitute the essential disease.

Prurigo mitis: the papules are smooth, soft, larger than those of lichen, seldom inflamed, save from scratching, some being covered by dark scales, accompanied by itching, and affecting especially young persons in the spring and the summer. *P. formicans* is the same disease in a more severe degree, the disordered sensation partaking more of a creeping character, wheals being raised by the scratching, and the papulæ larger. This variety affects the trunk and limbs especially. *P. senilis*, attacking old persons, and being characterised by itching of the most intense kind, large papulæ, great irritation of the skin, and often the presence of pediculi. In addition, Willan described certain local varieties, prurigo podicis, scroti, &c., which are now regarded as instances of *pruritus*.

Hebra says that he recognises as prurigo only the first and second varieties (the P. mitis and formicans) of Willan, and regards the senile prurigo as a cutaneous *pruritus*, itching being the essential thing, and the eruption, if any occur in the senile prurigo, being evoked by scratching; whereas in the other forms of prurigo, the papules are an essential and primary part of the disorder. But Hebra adds something more to his description of prurigo. He looks upon the P. mitis and formicans as forming only a part of true prurigo in its entirety; these make up a very small part of prurigo. His P. simplex or ordinary prurigo has the characters of Willan's

P. mitis and formicans in a marked degree, but he describes another condition which in its most severe form he designates P. ferox or agria.

Ordinary prurigo, according to Hebra, possesses these characteristics:—"Its earliest sign appears in the form of isolated subepidermic papules recognisable rather by touch than by sight, raised but little above the level of the skin, and not differing from the latter in colour, appearing in various parts of the body. They are accompanied by great irritation, and being scratched become red and raised, and at length covered over by a black scale of dried blood, and presenting then the features of an ordinary pruriginous rash. When this state has lasted for some time, a series of fresh phenomena appear. There is an increased deposit of pigment observed in the skin in the seat of the excoriations; the natural furrows become more distinct and separated, especially about the wrists, the back of the hands and fingers; the hairs thin out; the skin gets more dense and hard, and feels much thicker. But this is not all; occasionally an exaggeration of these phenomena are observed (P. ferox), the itching increases, the papules enlarge, the excoriations and blood-crusts are more developed and abundant. The epidermic peels off as a powdery substance, and suppuration of each papule may occur, or a condition of ezcema rubrum may be produced in a part or over the whole surface.

Hebra adds, "Going over the different regions of the body in a patient affected with prurigo, we shall find the scalp free, but the hair dry and covered over by a scaly dust; the face clear or showing a few papules, save in rare cases when it is eczematous; the throat and back of the neck free; the whole thorax, however, in front and behind covered with papules, some only to be recognised by touch, others being 'pruriginous,' (as we English understand.) The abdomen is likewise affected, so also are the buttocks and sacral region, but the limbs show the disease most certainly, especially on the exterior surface. The skin is discoloured, and thickened, and furrowed also, especially over the exterior surfaces. The leg below the knee presents the most characteristic appearance and feel, being as rough and harsh as a file. The armpits, hams, flexor side of wrists and palms, groins, and soles of feet, are unaffected. If there be much eczema, the glands are enlarged (prurigo buboes). The disease begins in early life, varies in severity, lasts a lifetime, and is incurable. It occurs in the badly nourished, and is aggravated by winter." According

to Hebra, it must be distinguished from pruritus cutaneus, excoriations produced by lice, scabies, chronic urticaria, eczema, ecthyma, and impetigo, when these complicate a primary attack of prurigo.

I have thought it most important to give this full description of what is now generally called Hebra's prurigo, a disease which does exist in Austria as Hebra depicts it, but which is infinitely rare, if it ever occurs in a well-marked form, in England. Now all the above described—P. mitis, formicans, and ferox—may occur without the vestige of a pediculus, and are quite independent of pediculi as the cause.

But what of prurigo senilis? Hebra denies its existence as a true prurigo, and says that in old people there is a pruritus cutaneus, followed by the consequences of scratching, but in which the characteristic lesion of prurigo, the papule, is not a primary lesion. I believe that prurigo may occur in the old as well as the young, and I am constrained to hold this opinion as the result of careful clinical observation. I know that mere intense pruritus, *sine* eruption as a primary or essential feature, often occurs, but so does prurigo (with eruption). I have seen recently as many as four cases in which there was well marked prurigo—the prurigo simplex of Hebra, the prurigo formicans of Willan—of recent production, commencing as an itching papular disease, and altered subsequently by scratching, in the case of three women and one man, all above middle age, and who were in every way scrupulously clean. Two of the women were cooks in the best situations, but addicted to drink; the disease affected the whole body in one, and the lower extremities in the other. The third woman was affected about the lower part of the body also. In the man the disease was pretty general. There never was the slightest trace of, nor the least reason to suspect, the presence of pediculi. A similar case was recently shown at the Pathological Society. Prurigo as distinguished from phtheiriasis may occur at any age, and therefore the term "prurigo senilis" is objectionable, as implying the existence of a disease peculiar to the old, and leading to confusion between mere pruritus with its consequences and true prurigo. I admit that true prurigo is comparatively rare in the old.

Further, pediculi may be found in connection with true prurigo, but Hebra and I perfectly agree that they do not produce true prurigo, for prurigo as defined above exists without them. They are accidental to prurigo, and they may be present and induce changes in the skin

without prurigo being present. It will be my object to show presently (1) that pediculi produce a special lesion when they attack the skin, (2) that this lesion is often absent, together with pediculi, in cases of prurigo, and often present when the lesions of true prurigo are absent, and (3) that the two are often co-existent. Prurigo, and pediculosis or phtheiriasis, are different things then.

But at this stage it becomes necessary to point out in more definite terms what the *essential constituents* of prurigo are. It will be gathered from what has been said that the main and chief features of true prurigo are intense and peculiar itching in connection with the development of papulæ of a special kind which undergo certain changes. All else that occurs is the result of the scratching and irritation set up. This being the case, it is necessary, as there are several different kinds of papules occurring in so-called "prurigo" which present close resemblances, that we distinguish between them—those which are proper, and those which are accidental, to true prurigo. In fact the neglect of this point explains in great measure the confusion which exists on the subject of prurigo and its nature. In a case of well-marked prurigo, in which pediculi are also present, we may have four kinds of papules, or lesions of a papular nature, present. No distinction is drawn between these several papulæ by writers or observers on and in matters dermatological. But it is very necessary that the practitioner should be acquainted with the characters of the several papules. These papules are—

1. Papules formed by congested and erected follicles.

2. Papules formed by deposit of lymph in the skin,—new solid formations.

3. Papules of special character, induced by the attack of the pediculus in search of nourishment, giving place to hæmorrhagic specks, and being independent of scratching.

4. The so-called broad papulæ or ædema and infiltration of certain limited portions of the skin, viz., the little areas enclosed by the natural furrows, and induced as the result of the continued irritation and scratching of the skin.

In addition to these four kinds of pimples, there are excoriations and the like, which cannot be confounded with pruriginous papules.

Now when papules are formed by congested follicles, by new deposit in the skin, or by the attack of pediculi, the individual upon whose skin they are developed, is apt to tear them with the

nails. The result is that a certain amount of blood is effused, and this dries in the form of a black crust, a feature which is regarded as characteristic of prurigo. The final aspect, therefore, presented by these several papules is similar, because they are all torn by the fingers more or less, and the differences presented by them in their earliest state are generally lost sight of. But it is to be observed that it is especially the congested follicles and the paler papulæ (new formations) that are mostly scratched. Of these different papulæ in their earlier conditions more must be now said.

Firstly. To take the papules referred to just now separately. Papulæ formed by erected and congested follicles occur whenever the skin is much irritated and much scratched, in the most healthy as well as the most unhealthy, and being scratched give rise to "pruriginous" papules, as they are usually defined. They thus occur in eczema, giving rise to pruriginous eczema; in connection with scabies, pemphigus, and lichen, as well as in connection with "prurigo." They are seen in the early stage to be seated at the follicles of the skin, showing in their centre the aperture of the follicular pore, they never occur without the signs of distinct irritation and after scratching, and they do not take origin from pale, but on the contrary red, papules. They are not peculiar to any, but incidental to many and different diseases of the skin.

Secondly. Papulæ acquiring the usual characters assigned to pruriginous papulæ, viz., the black apex (hæmorrhagic), and then presenting an aspect similar to that resulting from scratched and torn congested follicles, are present in true prurigo independent of any scratching, as a primary feature in the disease. They take origin from *pale papulæ formed by deposit of lymph in the skin*, and are thus unconnected with follicles of any kind, but rather the normal papillæ. These are the true papulæ of prurigo; they imply a profound disorder of the nutrition at large, and are specially related to nerve paresis. They are not the result of scratching, though often their original aspect is altered by scratching. Of course if the skin of a person predisposed to prurigo be scratched, or irritated by pediculi or any other irritant, the occurrence of prurigo and the development of pale papulæ will be precipitated.

Thirdly. There is another set of papulæ or pimples with a central black speck formed in connection with "prurigo," viz., those produced by pediculi. These are quite distinct from the papulæ formed from congested follicles or by new deposit in the skin.

They are like bug-bites at first, but the swelling induced by the attack of the pediculus soon subsides, leaving little or no elevation, but a distinct hæmorrhagic speck with a central punctum often clearly visible and through which the pediculus has sucked away blood. The pediculus does not bite, however, as we shall see presently. When I speak of what the pediculus does when it injures the skin, it will be seen at once that in the nature of things it is a minute hæmorrhage which it induces, and not a new deposit; though at the outset the hæmorrhagic spot exhibits some swelling round about it. I will only add here that the pediculi cannot be said to give rise to the development of the pale papulæ of prurigo by any direct action, nor to the congested and erected follicles, save in so far as they act in like manner as a host of other irritants.

Fourthly and lastly. The broad papulæ of prurigo, giving rise to a kind of "coarse urtication," need no special remark; they clearly result from long continued irritation and scratching.

Guided by the preceding remarks, let us see what explanation can be given of the "prurigo" of those who hold that all forms of disease to which this term has been applied in its widest sense, are caused by pediculi. It seems to me that there are four very distinct clinical conditions, if I may so put the matter, which go to make up the "prurigo" of authors. In the first place, there is (*a*) pediculosis or phtheiriasis or lousiness; (*b*) mal-nutrition of the skin (atrophy) connected with perverted innervation and the development of papulæ of a peculiar kind, or true prurigo; (*c*) pruritus cutaneus; (*d*) a mixture of these three conditions. It must be remembered that any one of these conditions may be accompanied by multifarious signs of irritation and scratching, such as congested follicles, ecthyma, eczema, urticaria, and the like. Or to put the matter in another way—*Phtheiriasis* is caused by lice, and consists essentially in the occurrence of severe itching and the development of definite hæmorrhagic papulæ, together with the consequence of scratching practised to relieve the irritation. *Prurigo* is characterised by a general state of mal-nutrition, disorder of innervation, such as formication, burning, intense itching, and the like, with the development of characteristic pale papulæ, and the ordinary results of scratching. *Pruritus cutaneus* is idiopathic itching, which may be followed by the results of irritation. These conditions may be conjoined in varying degree, but rarely so it is true. In both phtheiriasis and prurigo, in their separate existences, there are both

pathognomonic and accidental features. Erected and congested follicles, scratches, excoriations, ecthymatous pustules, and the like, are evidences of irritation common to both diseases, and indeed many others, and it is in hospital practice that we find all these things mixed up together. Pediculi find the surfaces of uncleanly and ill-fed persons exactly suited to their wants. In the more cleanly and better classes, prurigo is sometimes seen quite unconnected with the presence of pediculi. I ask, then, that we should separate prurigo from pediculosis or phtheiriasis, and no longer consider them synonymous; remembering at the same time that one may complicate the other. The frequency of phtheiriasis in hospital out-patients' practice is of course great, and phtheiriasis makes up the bulk of the so-called "prurigos." Further, we should accurately distinguish between the different and distinct origins of those separate items which together make up pruriginous papules.

Perhaps this is the best place to refer to the exact connection between the prurigo of Hebra, and the P. formicans and mitis of Willan. Are they different in nature, or do they only vary in intensity? As far as the evidence goes at present it would seem that these several varieties of prurigo belong to the same family, being all essentially characterized by the development of pale papulæ in connection with intense itching or formication. The secondary changes induced by the irritation and the scratching in P. ferox are so great as to entirely alter the aspect of the original disease, which occurs too at an early age, and is, in consequence of the profound disturbance in the general nutrition, practically incurable. This is all that we can affirm at present. I do not think that the Germans quite comprehend the features of prurigo as we see it in England, and I am sure that Englishmen are not acquainted with the differences presented by prurigo, in common with other diseases, as they occur in Austria and other parts of the world.

But I now proceed to discuss, more particularly with the view of showing the correctness of the preceding observations, the structure of the pediculus, and its ability to produce the various lesions attributed to it. One writer says*:—"I most strenuously assert, not only that body-lice are the invariable and sole cause of general prurigo in all its described varieties, but that each of the various symptoms, subjective and objective, of this disease, can be directly and satisfactorily accounted for by the presence of the lice

* British Medical Journal, Dec. 4, 1869.

on the skin: for example, the sensation of formication to their crawling over the skin; that of needles being thrust into the skin to their bite; the broad flat white papules I maintain are the analogue of gnat-bites; and so on." But the opponents of these opinions point with signal force to the occurrence of the sensation of formication in cerebro-spinal diseases as proof that this is quite independent of lice, and one of the best evidences of perverted innervation. I shall prove directly that lice cannot bite, that they have no jaws as generally supposed, and further it may be stated that the white papules—I suppose the "broad papulæ" are meant—have no central aperture.

But I will refer to an editorial article in the "British Medical Journal," December 4th, 1869, headed "Pedicularia,"—a new term again, and one which I find no one can quite understand,—for a fuller description of the evils produced by pediculi. We are told in the article in question, "The older writers knew well enough that lice sometimes caused terrible irritation; they even believed that they sometimes caused death; and to the states in which they were thus prevalent they gave the name 'phtheiriasis.' What they did not know, and what we do now know, is that, in addition to the terrible maladies occasionally met with in exceptionally dirty persons, there are multitudes of milder ones occurring in all classes, which are in relation with precisely the same cause, and can be cured only by its removal. Foremost among the maladies which we now associate with this cause are almost all examples of what used to be known as 'prurigo senilis,' some examples of 'urticaria,' and most of the cases of 'porrigo' on the heads of young persons. We have learnt also that 'prurigo senilis' is by no means restricted to the old, but may occur with precisely the same general features at any age, infancy alone excepted. We have learnt, also, that lice are by no means limited to the poor and dirty; but that they gain access not unfrequently to persons of all classes, and of the most cleanly habits. There are few medical men, ministers, school-teachers, or benevolent ladies, who do not run risks in this direction. We have learnt, also, what certainly we should not have expected, that these patients are able to give us little or no help in the diagnosis, and that lice may be present in abundance, and their host never suspect the fact. This remark again applies to all classes, to the most intelligent and observant as well as others; and it is a most important point to keep in mind. We have further learnt that the amount

of irritation produced varies exceedingly in different persons, being in many scarcely anything, and in others intolerable. Amongst the children of the poor in London, a large proportion have lice on the head, but only a small number present the 'porrigo' which they induce. So also in adults or aged persons; many have lice, and complain of no irritation."

I have no objection to the term "terrible" as applied to phtheiriasis, but I do not think that urticaria, prurigo senilis, and porrigo, make up a "multitude" of diseases. The fact also that pediculi "gain access" to persons of all classes, &c., does not prove that lice produce a "multitude" of diseases. It is not consonant with the general experience of medical men that lice can be present in abundance and their hosts never suspect the fact, certainly not, as one would be led to believe from the above extract, amongst the cleanly and more "observant" classes. The statement, however, that the amount of irritation varies under different circumstances, is explained by our knowledge that lice may gain access to the healthy and the cleanly, and fail to find the conditions necessary to their actual attack upon the skin; whilst in other cases in which the surface is badly nourished and dirty, they run riot, so to speak, and give rise to great disturbance in the skin. There is no attempt here to enquire after or to define any particular lesion produced by pediculi, but clearly a determination to maintain at all hazards the doctrine that "prurigo" in all its forms is due to lice. And what is the result in practice? That cases in old or elderly people in which there is intense itching with "pruriginous eruption," are declared to be due to pediculi, notwithstanding that there is not a particle of evidence forthcoming to prove their existence, or the signs of their presence or attack. Mr. Wilson has recently reported a telling case in which this cruel diagnosis was made of a disease which was essentially neurotic in character, and was relieved only by remedies calculated to meet such a case, and in which it was persistently asserted that lice *must* be present. I have seen similar instances. Further, the statement that "there are few medical men, ministers, school teachers, or benevolent ladies, who do not run risks in this direction," (*i.e.* as regards lice gaining access to them,) is quite true; but what does it prove? Nothing. It does not show that medical men, teachers or clergymen, or benevolent ladies, are the subject of "prurigo" in greater numbers than other persons. The statement is thrown in at random, and gives a false support to the main assertion.

But now for an examination of the very pertinent question—What injury or lesion does the pediculus produce in its attack upon the skin? It is a noticeable fact that in the recent discussions that have taken place on the subject of prurigo, not a single word has been said relative to the anatomy of that portion of the pediculus which is supposed to inflict injury upon the skin. It is a very common belief that the pediculus "bites." Mr. Squire still talks of lice-bites. Others say that the pediculus has mandibles, &c. Further, no distinction is made between the lesions occasioned directly by the lice and the scratching or disordered innervation. This part of the question is shirked. Certain eruptions are found on the skin, with co-existence of pediculi. The two things without further ado are linked together as cause and effect. But current belief is based upon considerable error as to the actual structure of the mouth of the pediculus. Pediculi cannot bite, and have no mandibles as usually supposed. An elaborate article on this question was published a year or two since by Professor J. C. Schjödte,* who clearly demonstrated the fact that the pediculus possesses a species of sucking apparatus, and not a mouth with mandibles. It seems that Swammerdam many years since maintained this view.† Gustav Simon, in his work on diseases of the skin,‡ states that Swammerdam's assertion that the pediculus is provided with an haustellum only, was disproved by Erichson as early as 1839, who declared that there were distinct mandibles and a pair of four-jointed palpi, and this opinion was supported especially amongst later observers by Dr. Leonard Landois.§ Professor Schjödte remarks in the first place that the general structure of the pediculus as regards its muscles, limbs, and other parts, is not such as would lead one to suppose it could attack by biting. If we take the head of a louse and examine it from underneath carefully, without a thin glass, and by reflected light and a low power, as Professor Schjödte says, we shall by altering the focus find what look like mandibles, but they are evidently beneath the skin. To determine the exact structure of the head, Schjödte took several lice and starved them for three days; then he put them on his

* Naturhistorisk Tidsskrift, ser. 3, vol. iii., Copenhagen, 1864, and Annals of Natural History, vol. i., 1866.

† Van de Ontleeding van de Menscheluys, Biblia Naturæ, i. 67.

‡ Die Hautkrankheiten durch anatomiche Untersuchungen erläutert, Berlin, 1848; p. 272-4.

§ Kolliker's Zeitschrift, February 1864.

hand to watch their attack on the skin. He tells us that "on their feeling the warmth of the skin, the antennæ began to 'oscillate with joy,' and the pediculus 'stretched all six legs out complacently from the body;' then it raised itself on its legs, going a few steps seeking and feeling its way with its antennæ. Presently, as seen with a magnifier, the louse drew in its legs a little, arched its back, bent its head downwards to the skin at an oblique angle, and projected repeatedly forward and drew back through the fore end of the head a small, dark, narrow organ; at last it stood still with the point of the head firmly abutted against the skin." If the insect be now taken away nothing is seen of the projected organ, but if it be left to itself undisturbed, new phenomena are noticed. At the top of the head, between and a little in advance of the eyes, a triangular blood-red point becomes visible, which exhibits rapid contraction and dilatation alternately, the digestive tract is also seen to be in lively peristaltic action, and it becomes gradually filled with blood, the œsophagus especially contracting forcibly. Now if at this stage the head of the animal is rapidly cut off just in front of the eyes with scissors, we are enabled to see the structure of the haustellum. The excised part remains attached to the skin, but with care can be taken away, and if placed under the microscope it shows a short dark brown protruding haustellum, provided with hooks at its extremity, out of which an excessively delicate membranous tube of varying length is hanging. If an attempt is made to examine with a higher power in the usual way, the protruding parts at once disappear as a consequence of the pressure of the thin glass, and then we have the old image with "mandibles" and "palpi." The slightest pressure forces the protruding parts back into the head. The way in which this occurs is explained in detail by Professor Schjödte.

"It seems that the mouth is like that in the rhynchota generally, but differs in the circumstance that the labium is capable of being retracted into the upper part of the head, and has a fold in it when so retracted. In order to strengthen this part a flat band of chitine is placed on the under surface, and it is thinner in the middle in order that it may bend and fold a little when the skin is not extended by the lower lip. The latter consists of two hard lateral pieces, of which the fore ends are united by a membrane, so that they form a tube, of which the internal covering is a continuation of the elastic membrane on the top of the head. Inside its orifice

are a number of small hooks, which assume different positions according to the degree of the protrusion, and if this is pushed to its highest point they form a collar of hooks curved backward like barbs. The pediculus first inserts its labium into a sweat pore, and protrudes the lip. When the hooks get hold of the parts around, then the first pair of setæ (the real mandibles transformed) are protruded, and these are towards the point invested by membrane so as to form a closed tube, from which again is exserted a second pair of setæ or maxillæ, which form a tube and end in four small lobes placed crosswise. The whole forms a membranous tube, along the walls of which, setiform mandibles and maxillæ are placed as long narrow bands of chitine. This tube can be lengthened or shortened at pleasure."

Such is, in his own words, but condensed in substance, Schjödte's description of the mouth of the pediculus. The "mandibles" seen by Landois, Simon, and others, being the chitinous bands on the under surface of the head, separated somewhat by the retracted labium which lies on the thin central part; the "palpi" are the barbs or hooks which fringe the orifice of the labium. Swammerdam's original belief is thus shown to be correct by Schjödte, who proves that the pediculus does not bite, but inserts its sucker, if we may so call it, into a pore, and so gets at the blood in the nearest capillary vessel. The reader will understand these several points if he will refer to the plate which accompanies this article, and which is a copy of Schjödte's figures given in the Annals of Natural History, vol. i. 1866.

Now it is quite clear if the above account of the anatomy of the pediculus, and the mode in which it makes its attack upon the skin, be true, that the pediculus must produce a lesion similar to the bug. The general direct and indirect results will vary somewhat according to the degree of healthiness or unhealthiness of the skin of the individual attacked, the amount of itching set up, and therefore the degree of scratching practised to relieve it. It is quite clear that the pediculus will give rise to a lesion which is essentially a minute hæmorrhage. There will be at the outset some swelling around the hæmorrhagic effusion, but this quickly subsides. If, as I have seen, pediculi get upon the surface of a healthy young person, the result will be the production at the outset of places exactly like so-called bug-bites, the swelling and minute bright red halo around the central "punctum"—the opening of the normal pores—soon goes, and a flat, non-raised hæmorrhagic

speck remains. If pediculi attack unhealthy subjects, there will be less inflammatory action oftentimes, and only the hæmorrhagic speck. The lesion produced by the pediculus therefore is a hæmorrhage, and it has the character of an effusion of blood from the very outset. It differs altogether from a papule which is subsesequently scratched and made to present a pruriginous aspect. None of the excoriations or pale papulæ seen in prurigo are produced by the pediculi; and, by the way, the pediculi do not dig holes with their claws, and then insert their haustellum through these holes. If it be asked, What does the pediculus do? I answer, Prefer uncleanly and ill-nourished surfaces; injure the skin by projecting its haustellum into the follicles, and, drawing away blood, leaving behind a small hæmorrhage, set up irritation, and give rise, with the aid of scratching, to follicular congestion, ecthyma, urticaria, and the like, the whole constituting pediculosis. This is conjoined to prurigo frequently, but the phenomena of prurigo—viz., intense itching, special papulæ, and an atrophous skin before described—may be present without those of pediculosis. The lesion produced specially by the pediculus is as characteristic of the presence of lice as is the cuniculus of the burrowing of the acarus. The reader will perhaps be good enough to refer back to what I described as the several conditions mixed up together with the term "prurigo," and he will see the exact relation which prurigo bears to pediculosis. The latter is a very common disease; this has long been taught by dermatologists. Let me repeat once more that when pediculi lead to scratching, and so induce urticaria, eczema, or ecthyma, they then act as ordinary irritants; there is nothing special in this kind of action. But when they induce minute hæmorrhagic specks, clearly not the result of an alteration in preexisting *papules* or excoriations, there is something special and characteristic. Pediculi should be searched for in the folds of that part of the linen worn about the neck and axillæ, and especially the little folds which are gathered together at the seams. It may be said that there must be a difficulty in distinguishing between the lesions produced by the pediculus and the bug, but the localization of the former in greatest abundance to the parts about the neck and axillæ, and the general aspect of the accidental features of phtheiriasis, at once preclude the possibility of mistake in well marked cases. There are some differences between the two lesions; besides pediculi would be found in the clothes of those affected by phtheiriasis.

And one word as to treatment. A difference is to be made between the treatment of prurigo and pediculosis. In the former case we have to meet a serious alteration of the nutrition at large, in which the nervous system is specially involved, to allay irritation, and to remove the ill effects of scratching. In the other—pediculosis or phtheiriasis—we have to destroy pediculi at all hazards, to improve the general health by good food more particularly, to bring the skin into a more healthy condition by the adoption of rigorous cleanliness, and to remove the evils produced by scratching.

Let me deal with phtheiriasis first of all. In order to get rid of pediculi we must not only get a clean skin, and apply to it some parasiticide, but also have frequent changes of clean linen, the old linen being thoroughly scalded when removed from the body. A warm bath each night with plenty of soap and water, the use of an ointment composed of stavesacre, or, as I think better, an ointment made with ten grains of white precipitate, two grains of musk, five drops of oil of lavender, and one ounce of lard, night and morning, will suffice to destroy the pediculi if the clothes are changed and scalded as before described. If ecthyma be present, quinine and other tonics and good food are called for. If urticaria or congested follicles in abundance be present, then we should, as I think, still use the same means, but also apply some cooling or soothing application, a lead and calamine lotion, or, if we prefer it, one made of two grains of bichloride of mercury to six ounces of rose water, with a little friar's balsam in it. After the pediculi are destroyed, the skin may remain for a time in an irritable and congested condition. Alkaline and bran baths with tonics, and zinc lotion, generally suffice to complete the cure.

It has been said that pediculi do not thrive better on unhealthy skins, but that through neglect they are there left undisturbed to pursue their ravages, and that all that is needed as regards treatment in phtheiriasis is simple bathing and washing with soap, and roasting of the clothes. But in hospital practice we cannot get proper ablution practised by patients, nor sufficient changes and roasting of linen; hence the necessity for using parasiticides.

The treatment of prurigo proper is a different affair. If it be complicated by pediculi, these latter must be got rid of at all hazards first. If no pediculi be present we have to deal essentially with a skin whose innervation is greatly disturbed, and into which is effused a good deal of plastic matter of a lower type

than that which makes healthy tissue. But, moreover, it is necessary to avoid the use to the skin of any remedies that are of a very stimulating and especially an irritating nature. Prurigo in the young generally implies that the attacked has been placed under the influence of those conditions which do direct violence to ordinary hygienic rules. Water, fresh air, soap, well-lighted and dry dwelling places, good and wholesome food, have been more or less unknown to them, and the general treatment consists in the use of these means. Then in the old, pruritus signifies a failure of the ordinary powers of nutrition, the ill consequences of which may be aggravated by such things as gouty tendencies, mental anxiety, &c. The free use of tonics, especially those calculated to improve the tone of the nervous system, are mainly required. Baths of an alkaline nature, with wet packing, especially where the skin is dry or very harsh, anodynes, subcutaneous injections, and the like, are the local means employed, but they are palliative rather than curative measures.

But I must forbear to enter into details as regards treatment. I have rather wished to devote this article to a determination of the nature and relations of prurigo and pediculosis, with a view to the establishment of the points of diagnosis between these two conditions, that being the matter of most pressing importance at the present time. For the details of treatment I must perforce refer the reader to my little "Manual of Skin Diseases." I do sincerely hope that a clear distinction may in future be drawn between prurigo and pediculosis or phtheiriasis, a distinction as to which Hebra and I most perfectly agree.

Finally, I cannot but add that it is certainly due to Hebra to state, that he was the first to clearly define for physicians the exact part which pediculi play in inducing irritation and scratching, and as a consequence ecthyma, urticaria, erythema, excoriations, and the like. Further, as it has been publicly stated that the "pedicular" origin of so-called prurigo, or, as it should be called, phtheiriasis, as seen amongst hospital out-patients, has been but recently taught at University College Hospital, I must say that this is an error. I certainly was taught when a student at University College to recognise the connection between pediculi and pruriginous and other eruptions, in accordance generally with Hebra's views, and to seek for pediculi in cases of "prurigo senilis." The particularly novel points to which I now call attention, are the structure of the mouth of the pediculus, and the lesion which the pediculus is

capable of directly producing by its attack upon the skin, and I hope to have assisted in no little degree in clearing away much of the very considerable ignorance which exists touching these matters. I venture again to repeat that a clear distinction should in future be made between prurigo and pediculosis or phtheiriasis, and I appeal to my readers to enforce this distinction.

EXPLANATION OF PLATE II.

Fig. 1 represents the parts of the mouth in a large specimen of *Pediculus vestimenti*, entirely protruding and seen from above, magnified one hundred and sixty times (after Schjödte).

a a, the summit of the head, with four bristles on each side.

b b, the chitinous band, and *c*, the hind part of the lower lip—such as they appear through the skin by strong transmitted light.

d d, the foremost protruding part of the lower lip (haustellum).

e e, the hooks turned outwards.

f, the inner tube of suction, slightly bent and twisted.

The two pairs of jaws are perceived on the outside as thin lines; a few blood-globules are seen in the interior of the tube.

Fig. 2 is a repetition of Erichson and Simon's figure of the organs of the mouth in *Pediculus capitis*.

a, the haustellum.

b, the so-called "mandibles."

c, the so-called "palpi."

(Simon, Die Hautkrankheiten, tab. 7, fig. 4.)

PLATE II.

Fig. 1.

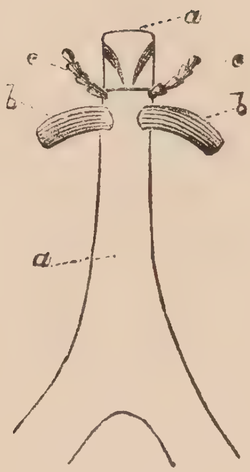

Fig. 2.

Fig. 1.—STRUCTURE OF MOUTH OF PEDICULUS VESTIMENTI.

Fig. 2.—SIMON'S REPRESENTATION OF MOUTH OF PEDICULUS CAPITIS.

ON INTERMITTENT PULSE AND PALPITATION.

By Benjamin W. Richardson, M.D., F.R.S.

Two years ago I brought forward the subject of Intermittent Pulse and Palpitation as one of the lectures in my course of Experimental and Practical Medicine. The phenomenon of intermittency in the pulse stroke of the heart had then been under my observation for many years, and on the facts relating to it, thus learned clinically in the first instance, the lecture was based. It was not however until after the lecture was published that I was conversant of the practical interest which the profession took in the question discussed; and indeed I am in doubt whether any paper I have ever written has, on the whole, created a keener interest. In brief, I struck upon a subject with which all practitioners were acquainted, but respecting which little had either been written or spoken; thus there was excited a general desire and curiosity to receive, even as a novelty, an old and familiar study.

Since the time when the lecture became known in the profession a very large number of cases of intermittent pulse have been brought under my notice. I have consequently been able to relearn the subject from a position extremely favourable for the labour, and as it embraces many questions of importance relating to physiology and practice, I venture now to revise what I have previously written, and to add such new facts as have been presented to my mind.

DEFINITION OF INTERMITTENT PULSE.

In relation to time there are in disease three distinct variations in the beat of the pulse.

(1) There is a beat which may be called an *acute irregularity*, in which each stroke is given in correct order of succession the one stroke to the other, but in series of five, ten, or other number of beats differing in rate from other series. In cases of very feeble

heart we often meet this condition, we meet it in anæmia, we meet it after loss of blood and other serious depressing conditions.

(2) There is a beat which may be called a *prolonged irregularity*, in which the pulse shall during one minute register say seventy, and if counted through a succeeding minute, ninety or a hundred beats. This form of irregularity, in relation to time, is met with most distinctively in cases of acute cerebral disease, especially in the hydrocephalus of children. In hydrocephalus, according to my experience, it is a fatal sign; I have never known an instance of recovery, when, with other acute symptoms pointing to the brain as the seat of the acute disease, this prolonged irregularity has been markedly present.

(3) Lastly, there is the kind of irregularity which is to be studied in the present essay—the irregularity known to us all, and known to many of the intelligent public, by the term *intermittency*, and connected often by the patient with the further definition *palpitation*. This irregularity consists of an absolute loss of certain of the normal beats of the pulse; it is as though the pulse were clipped out for the moment, the intermittency of stroke occurring during the whole interval of a normal stroke, or in extreme cases covering the time of two, three, or even a greater number of natural pulsations.

PHYSICAL CHARACTER OF INTERMITTENT PULSE.

If we turn to the heart to tell us what is the reason of the hesitation of the pulse when it intermits, we discover readily enough that the gap is due to a break or holding back of the ventricular systole. We listen for the heart sounds, the *Lūb, dúp*, followed by the *pause*, and all goes on correctly a given number of times, when suddenly there is, as it were, a revulsion—I know no better term—and with that the hesitation in the arterial beat. We wait for a return of the phenomemon, we analyse it carefully, and we read that it is connected with an entire absence of the first or long cardiac sound, with a very faint second sound, and with loss of the pulse, followed usually by a heavy thud of a returning first sound, by two sharp and very distinct but faint quick second sounds, and by return of the pulse.

We infer from this reading what has happened in the cardiac mechanism; we infer that the left ventricle, at all events, has, for a moment, failed to contract on its contents, the blood within it. Thus, the column of blood which is always left in the arteries waiting for

ventricular impulse is reduced passively by mere arterial contraction, and the pulse is lost, because there is no wave projected along the artery from the heart. Following on the second of the two succeeding diastolic sounds, the pulse returns; the revived systolic contraction, having first re-supplied the arteries, next overcomes arterial tension and reproduces the pulse wave.

It seems difficult at first to account for the two rapid diastolic sounds which follow one upon the other. At one time I thought the double diastolic sound, the quick *dúp dúp*, was due to the circumstance that at the moment of intermittency the left ventricle of the heart alone fails to contract, and that the double returning second sound is produced by a separate instead of a simultaneous closing of the pulmonary semilunar and aortic semilunar valves, the pulmonary valves continuing to act in their proper order and closing twice in the same time that the aortic valves close once, until the simultaneous action is restored. I am however induced, by further research, to believe that this view does not quite correctly explain or define what really occurs, and I therefore beg to offer a revision of the subject, under a separate head.

MECHANICAL CAUSE OF INTERMITTENT PULSE.

When we write the sounds down in order, before, during, and after an intermittent act, thus—

Natural.	Ventricular intermittency with loss of pulse.	Returning long ventricular systole with return of pulse.	Natural.
Lūb dúp 0	0 dúp 0	Lūb dúp dúp	Lūb dúp 0

the phenomenon of intermittency is seen clearly enough, I think, as dependent on failure of the action, I will say first, of the left ventricle. In what does that failure consist? Does the ventricle not contract, or does it contract and find no blood upon which to close? The evidence on this point is very sound. It goes at once to show that the ventricle does not contract; if there were no blood in the ventricle, there must be blood in excess in the pulmonary circuit and in a hugely distended auricle, of which conditions we have no indications whatever. That is the negative side; but there is positive, almost speaking, evidence of what has occurred in the long thud of the returning systolic sound which proclaims the ventricle again at its work, and which tells that it is contracting on a more than ordinary

volume of blood within its cavity. If these evidences, then, be true, the intermittency of the arterial pulse occurs from an independent failure of action of the left ventricle of the heart. The ventricle continues in diastole for two or more strokes of the systole of its auricle, and then relieves itself by a prolonged effort: it is like a man who, striking at the forge a number of strokes in rhythmical succession until tired of the action, changes it for a moment to give a more deliberate and determinate blow, and then rings on again in regular time.

This no doubt is true in relation to the left ventricle, but is the failure confined to the left ventricle as originally assumed, or do both right and left ventricles fail? I am now of opinion that both ventricles fail, and that the order of change from the natural through the unnatural and again to the natural is as follows.

The ventricles, filled by the systole of the auricles, fail to contract on the blood contained in them; thus the system altogether is left with the arterial side of the heart full, with the arteries contracted on a small column of blood, with the veins full, and with the right side of the heart full both in auricle and ventricle. In a word, the whole circulating system is left containing blood, so that the line of the blood current continues unbroken. During the interval of the cessation of the action of the ventricles blood is, moreover, still entering the right auricle from the two cavæ, by that continuous force which the older writers called the *vis a fronte*, and the auricle remains in motion, contracting on its contained blood. A column of blood is in this way still carried into the pulmonary artery, and, the artery contracting, a feeble second sound is produced after the loss of the systolic sound by the closure of the pulmonary semilunar valves. Lastly, when the ventricles again contract, contracting as they do at this time on a double charge of blood, there is produced the long heavy systolic sound followed by the two sharp faint second sounds, the reduplication of the second sound being due either to a separate closure of the pulmonary and aortic sets of valves, or to a simultaneous double but feeble closure of both.

ORGANIC CAUSE OF INTERMITTENT PULSE.

In these explanations I have dealt simply with the mechanical cause of the abnormal phenomenon of intermittency of the pulse. Now arises the question, What is the more elementary organic cause? Let us study this question by the process of exclusion.

We should naturally again begin by looking into the structure of

the heart for a cause. We should be wrong. The fact alone that during the intervening periods of intermittency the action of the heart is natural, would go far to indicate that in it there need be no serious organic lesion. Still this of itself would be little were it unsupported by more direct evidence. Being greatly interested in this matter, I seized once the opportunity of examining after death the heart of an aged man who for many years presented the phenomenon of intermittency more determinately than I ever before had seen: his pulse never, as far as I could learn, failed to intermit less often than once in eight beats. His death was from senile decay, but his circulation may be said to have outlived all the other of his systemic powers. When quite insensible, the pulse, with long hesitations, came up again, and the pulse was beating at the end, even when the respiration had ceased. After death, instead of a diseased heart, the heart was found the healthiest of the organs of the body. There was no trace of valvular disease. There was no departure from the natural size and condition of the cavities or the thicknesses of the walls; the coronary arteries were normal, and the muscular structure, quite free from fatty and granular degeneracy, was merely, as the tissues are in the aged, a shade paler than is common in the young and robust. Since the occurrence of that case I have confirmed the experience then gained by three other experiences. I feel bound therefore to say, from what I have seen, as positive truth, that the most marked intermittency of the heart may be present without evidence of any known form of organic disease of the organ itself; and, as one fact carefully assured is as good as a thousand, I am driven to accept that there is no known morbid condition of the heart itself, structurally considered, that produces the phenomenon of intermittent action. Intermittency may co-exist with other signs of cardiac derangement essentially of structural origin; a fatty heart may intermit; a heart with faulty valvular mechanism may intermit; and intermittency with structural change may form, and often does form, a most serious complication. These facts we must at once allow, but we must allow them feeling that the intermittent action, having no necessary connexion with the structural disorder, is evoked by a cause remote and independent. Pre-existent diseases of a special kind, such as acute rheumatism, do not, so far as I can learn, leave intermittency specially in their train; neither, as far as I know, is the phenomenon more common in those who have structural disease of the heart than in those who have not.

From the study of the heart itself we may turn naturally to the digestive system, and ask if there can be any cause for the symptom in functional or organic disease there? May not the symptom, that is to say, be due to some one of the many forms of dyspepsia? On this point my observations lead me to assume that intermittency of the heart has no relation to what is commonly called "dyspepsia." It is true that many dyspeptic persons have intermittent pulse, but this fact does not affect the question, because it is equally true that many persons who have determinate intermittency of pulse have the most keen and excellent digestion. I have a patient at this very time whose case is strictly in point: his pulse intermits every sixteenth beat, but his tongue is clean, his urine natural, his appetite good, his sleep sound, and his bowels regular. After taking food he has no pain, he has no flatulency, and, according to his own often repeated expression, "he does not know that he has a stomach." On the other hand, we constantly see dyspepsia in all its varied and severe forms without the sign of intermittency.

In publishing for the first time on this subject I held, as above, that dyspepsia has no necessary relation to the prime cause of intermittency, and although Dr. Leared and some other learned friends, for whose opinion I have the greatest regard, have disputed the position, I am forced to re-affirm it. I admit that many persons who are dyspeptic have intermittency of the pulse, and I believe there are cases in which dyspepsia itself is due to some similar cause as that which is at work to induce intermittent action; so that the two symptoms running together, the one—unless the analysis be searching—may seem to stand in relation either of cause or of effect to the other, whereas they are simply co-incident symptoms. Further, I am quite willing to allow that in persons who have what may be correctly called "recurring intermittency," the recurrence may, and indeed often does, present itself with symptoms of dyspepsia. Further still, it is I think possible that in those who are disposed to intermittent pulse, an attack of dyspepsia may, by the irritation and deprivation of general power which it induces, aggravate the symptom of intermittency. But this is the position I accept, nature leading me to it,—that amongst the large numbers of persons who have intermittent pulse none owe it simply to dyspepsia; that its cause lies beyond dyspepsia even in the dyspeptic; and that it may be present in its most aggravated form when dyspepsia does not exist at all.

I know of no diseased condition of the blood with which the

phenomenon of intermittency is connected. Neither have I been able, after careful research, to trace it, in the light of effect from cause, to any affection of the lung, the liver, the kidney, or other secreting or excreting organ.

Thus we are driven at last to one sole system of the body in which to seek for the origin of the phenomenon of intermittency of the heart; and that is the nervous system. Followed to this seat, all the evidence is too unequivocal to be doubted. The frequent sudden development of the phenomenon, its purely functional character, in so far as the heart is concerned, and the other symptoms by which it is attended, leave no room to question the correctness of the view that the momentary cessation of the ventricular systole occurs from deprivation of or opposition to the nervous force by which the ventricles are enabled, under the stimulus of the blood thrown into them by the auricles, to contract upon and regulate the blood currents in their course.

All the evidences, again, point to the fact that, in every case of true intermittency, one particular point or centre of the nervous system is the primary seat of the derangement. The phenomenon is too uniform to admit any explanation less definite; it speaks to us and says that either there is deficiency of force in the centre of the nervous system which provides for ventricular contraction, or there is some centre which balances or controls that supplying centre, and which, rendered over-active from irritation, is interfering with contraction.

The derangement might be in the ganglionic centres of the heart itself; but if it were, the nutrition of the organ would surely be more decidedly influenced, and the cardiac symptoms would not be intermittent, but persistent. The derangement might be from irritation in the periphery or in the branches of the pneumogastric; but if it were, it would hardly be continuous for years, with no other sign of muscular disturbance. Where then is the primary mischief? I believe it to be in some mental centre of the nervous system. The clinical history of every case I have seen points to that truth. In the aged, intermittency is an almost invariable follower of failing power; in the very young, it presents itself with other indications of mental derangement or feebleness. But that which impresses me most in favour of this origin of intermittent pulse is the mode in which it appears in the prime of life. I have never met with a case in which it has not been traceable to some form of mental excitement with succeeding depression. Grief imposed by the deaths of relatives and

friends; shock from failures of enterprises in business; disappointments; violent outbursts of passion; remorse; degradation; and, most fruitful cause of all in this madly striving age, over-work and worry, these are the outside influences leading to the systemic change on which the phenomenon of intermittency of the pulse depends.

In my original essay I expressed these same views, and my experience during the last two years, an experience quite exceptional, has strengthened them in every particular. In not one case, except where the influence of old age has come in to perform its part, have I failed to trace the disease back to what may be called mental shock. In many instances the patients have themselves described to me the first occurrence of the symptom as derived from their own immediate knowledge. The facts admit of no two readings. I will give a few illustrations.

INTERMITTENT PULSE INDUCED BY TERROR OF SUDDEN DEATH DURING SHIPWRECK.

A gentleman of middle age was returning home from a long voyage in the most perfect health and spirits, when the vessel in which he was sailing was struck by a larger one, and, hopelessly injured, began to sink. With the sensation of the sinking of the ship and the obvious imminence of death—five minutes was the longest expected period of remaining life—this gentleman felt his heart, previously acting vehemently, stop in its beat. He remembered then a confused period of noise and cries and rush, and a return to comparative quiet, when he discovered himself being conveyed almost unconsciously out of the sinking vessel, and on to the deck of another vessel that had rendered assistance. When he had gained sufficient calmness he found that the periods of intermittent action of his heart could be counted. They occurred four or five times in the minute for several days, and interfered with his going to sleep for many nights. On landing the intermittency decreased, and when the patient soon afterwards came to me there were not more than two intermittent strokes in the minute, all the intervening strokes being entirely natural, and the action of the heart and the sounds of it being simply perfect. In this gentleman the intermittent pulse became a fixed condition, but so modified in character that it was endurable. At his last visit to me he was not conscious of the symptom except he took it objectively from himself, by feeling his own pulse or listening to his own heart.

INTERMITTENT PULSE FROM ANXIETY.

One of the extremest cases of intermittency of pulse I have yet seen was in the person of a member of one of the learned professions, who by an innocent, but in his case imprudent, act, brought himself under ecclesiastical censure. The result was his removal from his position and indeed from his profession, and during the anxiety and as he felt unmerited disgrace which followed, the intermittent motion of his heart was developed. In this instance the mischief continued until at length it was an ever conscious fact to the sufferer, and for months prevented anything like natural sleep. He could not lie down lest the heart should stop altogether, and although I and two medical friends did all in our power to give rest, we could never restore the balance of natural action. In this instance the persistent intermittency, and the silent but terrible and sleepless suffering it produced, caused gradual failure of power and death.

INTERMITTENT PULSE FROM GRIEF.

Grief, especially when it is combined with exhaustion of the body, is a very common cause of intermittent pulse.

(1) A young woman, an out-patient at a public hospital to which I was formerly attached as physician, came before me with an intermittency of the heart which could be counted twenty-three times in a minute. It was in plain truth a painful duty to feel her pulse, and it was matter of wonder to me how life could be sustained with so broken a current of arterial blood pervading the system. The cause of the disorder was here manifest enough, and was clearly traceable to its origin. The poor woman had lost, from epidemic disease, three of her children—all she had—at one stroke. In the midst of her grief she miscarried, and suffered from severe hæmorrhage. At the time she came to me she was still suffering from menorrhagia. Under tonic treatment and good food, coupled with soothing and encouraging words and hopes, this patient recovered beyond my first expectations. At the last visit she paid to me, the intermittency was reduced to a single failure in one hundred and sixty pulsations.

(2) In another case, one I have now had under observation for five years, the patient, a gentleman about sixty years of age, told me that he became first conscious of intermittency in the action of

his heart, upon the anxiety he felt from the loss of one of his brothers, to whom he was deeply attached, and for whose superior talents he had, as indeed many others had, a profound admiration. The attacks at first were so severe, that they created in his mind some alarm, but in course of time he became accustomed to them, and the sense of fear passed away. The intermittency in this case alternates with periods in which there is very slight interruption of natural cardiac action. During these more natural periods there is however an occasional absence of systolic stroke once in two or three hundred beats, but the fact is not evident to the subject himself. When the extreme attacks are present the intermittency of pulse occurs six or even seven times in the minute, and the fact, which is subjectively felt, is very painful. The stomach at the same time is uneasy, there is flatulency, and a sensation of sinking and exhaustion in the region of the stomach. In the worst attacks there is also some difficulty in respiration, and a desire for more capacity for air, but unattended by spasms or acute pain. A severe attack is induced readily by any cause of disturbance, such as broken rest or any mental excitement; on the other hand, rest and freedom from care seem definitely curative for the time.

In this case another symptom was presented for one or two years, which is somewhat novel, and exceedingly striking in a pathological point of view. The symptom was this. When the intermittent action of the heart was at its worst there came on in the fingers of one or other hand a sensation of coldness and numbness, followed instantly by quick blanching of the skin, and precisely the same appearance as is produced when the surface of the body is frozen with ether spray. The numbness and temporary death of the parts would often remain even for an hour, during which time the superficial sensibility was altogether lost. When recovery commenced in the fingers it was very rapid, and after recovery no secondary bad effects were ever noticeable.

INTERMITTENT PULSE FROM PASSION.

In some cases outbursts of passion are the prime source of intermittency of the pulse. One striking example of this nature was afforded me in the case of a member of our own—the medical—profession. He admitted to me that an original irritability of temper was permitted, by want of due control, to pass into a disposition of almost persistent or chronic anger, so that every trifle in his way was a cause of unwarrantable irritation. Sometimes

his anger was so vehement that all about him were alarmed for him even more than for themselves, and when the attack was over there were hours of sorrow and regret, in private, which were as exhausting as the previous rage. In the midst of one of these outbreaks of short madness this gentleman suddenly felt as if, I use his own expression, as if his "heart were lost." He reeled under the impression, felt nauseated and faint; then recovering put his hand to his wrist, and discovered the intermittent action of his heart as the cause of his faintness. He never recovered from that shock, and for ten years, to the day of his death, he was never free from intermittency. As a rule he was not conscious of the intermittency unless he took an observation on his own pulse as though he were apart from himself, but occasionally after severe fatigue he would be subjectively conscious of it, and was then much distressed and depressed. "I am broken-hearted," he would say, "physically broken-hearted." And so he was: but the knowledge of the broken heart tempered, marvellously, his passion, and saved him many years of a really useful life. He died ultimately from an acute disorder.

INTERMITTENT PULSE FROM EXCESSIVE FATIGUE.

After excessive mental and bodily fatigue intermittency of the heart is a frequent symptom. Indeed when such double fatigue is long continued, few persons escape. For this reason the symptom is exceedingly common in members of the medical profession who are exposed to night work, and who in the presence of serious care secure little rest. I have seen a large number of cases of this character.

A medical man in large general practice, who was in the habit of attending from three hundred to three hundred and fifty cases of midwifery in the year, and who rarely had two consecutive nights of unbroken rest, was suddenly exposed to mental depression, incident upon the death of his wife. His first acute symptom was a sharp pain running down the right side and right arm, and soon succeeded by a sense of internal feebleness. The sense of exhaustion was referred chiefly to the lower part of the chest anteriorly, and to the region of the heart, but the sufferer himself was not subjectively conscious of intermittent cardiac action. On examination I found that the cessation of the ventricular systole occurred from six to seven times in the minute, and extended not unfrequently

over a full period of two seconds. I learned also after a short time that the sense of exhaustion was always co-incident with the periods of extreme intermittency. After a few nights of rest, and some mental quietude, this patient made a fair recovery, and became able to carry out a considerable share of his professional work. But a little over-fatigue, a return of broken sleep, or even a slight over-taxation of the stomach, are sufficiently potent causes to reproduce the cardiac irregularity, with the sense of central exhaustion described above. Emotional excitement of any kind, if at all prolonged, is equally the exciting cause of a relapse.

This is a good typical case, selected from many of a similar class. In all I have observed the character of the work to be the same: it has been work not simply muscular, not simply mental in the purest sense of the term, but work in which great prostration from broken rest has been accompanied with equally great mental anxiety respecting results. From my observations I infer, on very safe grounds, that a man or woman may undergo any possible amount of pure muscular work without showing the least sign of intermittent action of the heart. The heart may wear out under muscular fatigue, and present various forms of organic changes, but it need not necessarily intermit with or from these changes. I infer again, also on very safe grounds, that actual hard work of brain, if the work be of a kind which does not excite the worker, or call into action the emotions, or lead from rest of sleep, may be carried on, even to apparent excess, without causing intermittent action of the heart. But whenever in conjunction with broken rest there is excess of labour, irregular mode of life, and, added to both, *anxiety*, then the conditions are present for the development of the phenomenon of intermittent action.

INTERMITTENT PULSE FOLLOWING UPON ADVERSE FORTUNE.

There is no more common cause of intermittent pulse than extreme reverse of fortune. A man poor at all times, having never felt the pride and power of wealth, may live to the fullest length of days free from any irregularity of circulation: but a rich man, and especially a rich man who has once been a poor man, brought suddenly low by adversity, rarely escapes that physical change, the outward manifestation of which is intermittent stroke of the heart. I could fill many pages in illustration of this fact, and could account, on physical principles, for some painful catastrophes which the world at large would probably trace to moral or rather immoral

or immaterial agencies. Thus the physical basis of suicide lies in such close proximity with the basis of intermittent heart-stroke, that I doubt if man or woman with perfectly acting heart did ever commit the act of self-destruction. Suicide is in fact a disease presenting certain well-defined physical symptoms, a disease admitting of diagnosis, a disease in which the *act* of suicide is but one part, a part holding the same relation to the disorder as the natural act of death holds to other disorders. Intermittent action of the heart as a sign of failure is therefore, when blended with other physical signs of the disease suicide,—on which I will one day try to speak at greater length,—an important sign, not of any value of itself absolutely, but of extreme value as part of a series of symptoms, which taken altogether are diagnostic.

I could give the history of many cases in which reverse of fortune has led to intermittent action of the heart, but one illustration will serve.

A person, aged fifty, living in easy circumstances and having little occasion to think of tomorrow, received news that a banking firm in which all belonging to him was embarked had suddenly collapsed. The shock at first produced faintness and coldness of the surface, followed by what was called "fever." In this stage of anxiety he was subjected also to some over-exertion, and to what seemed a chill from coldness of the air. He went to bed restless, and in sleep continued to dream of his losses. At one o'clock in the morning he awoke with a sensation of being engaged in a struggle, and soon became conscious of what is called "palpitation of the heart." It was not however a common palpitation, for it was attended with frequent cessation of action. In a few minutes the paroxysm subsided, but from thenceforward the pulse has continued to intermit, and vehement paroxysmal seizures of severe intermittent action, extending to embarrassment of the respiration, have many times been experienced. At the last visit paid me by this patient, the anxiety on which the symptoms depended having lessened, the acute paroxysms had passed away, and the intermittent action, which the sufferer could always detect, had become "endurable."

INTERMITTENT PULSE PRECEDING ACUTE MANIA.

Cases of acute mania not uncommonly, during their preliminary stages, afford typical illustration of intermittency of pulse.

(1) I was called once by a medical friend in the country

to meet him in consultation in the case of a lady who was suffering from phthisis pulmonalis. When our consultation was over he asked me if I would see a working man, a mechanic, who was suffering from some peculiar condition of depression and occasional excitability, with a singular irregularity of the circulation. I found soon before me a fine, healthy-looking man, restless and miserable, and on listening to his heart I discovered an intermittency of action occurring at every ten or twelve strokes of the heart. At this time I knew nothing accurate as to the cause of intermittency, and therefore assumed that the heart itself was the seat of the malady. With this in my mind I suggested the administration of some tonic remedy, and expected to hear of a slow recovery, never dreaming of the advent of any acute disorder. But a few days later I was requested to visit the same patient in a public metropolitan asylum. Then I learned that a day or so after my first visit to this man he had suddenly manifested acute mania, had attempted to injure some of his friends, and had made a serious and nearly successful attack on his own life. At my second visit on this patient the maniacal attack had passed away, and the pulse was now as regular and tranquil as could be. He made ultimately a good recovery.

(2) In a second case, which was long under my care, the case of a lady who had passed the middle period of her life, and who had been under restraint for temporary insanity early in her career, intermittency of the pulse was an invariable preceding symptom of attacks of semi-acute mania. In this case the maniacal symptoms were always emotional. However severe they were, however violent they were, there was some reasoning faculty intact, which, as a rule, enabled her to control herself. So certainly premonitory of an attack was the intermittent pulse in this lady, that she herself was conscious of the premonition, and often sent for me simply because she had detected in it the first sign of an outbreak. She lived on in this way many years, and died at last from simple organic failure of the alimentary organs, her intellect remaining clear nearly to the last.

INTERMITTENT PULSE FROM HEREDITARY PREDISPOSITION.

In two cases I have been consulted by patients suffering from intermittent pulse, who assigned hereditary predisposition as the cause of the irregularity. An analysis of the evidence presented in these cases seemed to me to establish the truth of the position

assumed. Both patients were young, both had been free of any great and sufficient exciting mental cause, and both stated that their parents on the male side had suffered severely from the symptom, and that they in turn considered the symptom to have come, by descent, from their parents. It is fair however to notice that one of these two patients was subjected to considerable fatigue, involving disturbance of rest at the time he became aware of the inconvenience, that the action of his heart was feeble, and that there was a constant sense of weariness, although his body was well formed and nourished, and his general appearance healthy. In this case the intermittent action was sharp and abrupt, and there was no double second sound, the interruption giving rise to a modification of heart sounds like this; —from the natural Lūb dúp 0, to 0 dúp 0, followed by the natural Lūb dúp 0. Under rest there was great improvement in both these cases, and I believe the patients are still living and pursuing their ordinary occupations, with little inconvenience; excess of exertion requires however to be strictly avoided by them.

CONGENITAL INTERMITTENT PULSE.

In one instance I noticed an intermittent pulse in an infant on the day of his birth, and it continued in him in the most marked degree for five years. It then gradually passed away. A medical friend once also brought me one of his children, a boy five years old, who had the symptom in an intense form, so that his parent was seriously alarmed; but the boy himself was quite unconscious of any suffering or ailment. In this case the symptom has disappeared, and the boy, now nearly fourteen years old, is in good health.

INTERMITTENT PULSE FROM OLD AGE.

In old age intermittent action of the heart is exceedingly common. It is very rare indeed to find a person above seventy who does not present the symptom. At the same time it is not necessarily connected with length of days, for I once had the opportunity of examining the pulse and the heart of a woman, in the workhouse at Birmingham, who had attained the remarkable age of one hundred and three years, and in her case the sounds of the heart were as perfect as they could be in respect both to tune and time. The action of the heart was naturally feeble, and the strokes were fifty-eight in the minute. There was also perfect natural accord between the respiratory sounds and those of the heart. This woman could

always eat, drink, and sleep well, and it is singular that she was a devotee to tobacco. She smoked from the time she was a young woman, and no greater punishment could be inflicted on her than the depriving her of her pipe. In the old, when intermittent action of the heart comes on, it appears to indicate only a natural failure of power, and especially of power in the digestive apparatus and the other systems of simple organic or vegetable life. When aged people thus affected are dying from prolonged senile sleep, it is often to be observed that the intermission of the action of the heart extends over periods of several seconds, so that the observer wonders how life can be sustained.

GENERAL NOTE ON CASES OF INTERMITTENT PULSE.

In the illustrative cases given above I have, I think, briefly but fairly indicated the great classes of cases in which the phenomenon is developed. From what I have learned it does not occur to me that intermittent action is peculiar to either sex; I find, in short, that there is no particular age at which I have not met some persons who have intermittency of pulse. But it must be admitted at the same time, that the symptom is most frequently seen in persons of advanced life, and that in very aged people the absence of it is the exception rather than the rule. It is by no means unfrequent in persons of middle age, and it is as common in those who are prematurely as in those who are veritably old. It is least frequent between the ages of ten and thirty years.

INTERMITTENT PULSE IN INFERIOR ANIMALS.

I noticed in my original essay on intermittent pulse that the symptom was sometimes met with in dogs. A neighbour of mine had an old Italian greyhound which presented the phenomenon in the most singularly distinct form. I also had a dog that presented the symptom; this animal was not young, but hearty, and disposed to fat and somnolency. I have since met with several cases in dogs, but not in any other animal. It would be a very interesting and at the same time useful enquiry in comparative pathology to determine if the symptom be present in other animals, in horses specially, and I should be obliged if any medical man or veterinary surgeon who might observe the symptom in the lower animals would either favour me with the facts for publication or publish them independently.

And now that we have had before us the clinical history of intermittent pulse it is time to resume our study of the organic cause of the symptom. We have already seen that the heart itself is not the organ organically diseased; we have excluded the blood; we have excluded the digestive system ; and we have been driven to the nervous system as the seat of the organic mischief. The question remains—In which of the two great nervous systems is the change which leads to failure seated ? Is it in the cerebro-spinal system ; or is it in the great system of organic life—the sympathetic system ?

In my original lecture I took the view that the primary mischief was in the cerebro-spinal system, and was cerebral. In putting forward this view I was influenced by the idea that, because the disorder was excited by certain acts which we call mental, therefore the cause of the disorder was in the cerebrum. This hypothesis carried with it the commonly accepted notion that all mental impressions are received in, and that all mental acts proceed from, the cerebrum ; a notion we cannot now hold with certainty. Our more modern observations lead us back to the view of the illustrious Bichat that the great ganglionic system is possibly the seat of all those mental acts which the metaphysician has designated as the emotions, passions, and pure instinctive expressions of man ; the cerebro-spinal being the system of the pure intellectual life,—the life that learns and teaches, and in the highest natures controls even the emotions,—the life that supplies the evidence of the superior gift of conscience and consciousness, and which raises the human so far above the other animal existences.

With this change of theory respecting the functions of the great nervous systems, there must flow change of view in respect to the seat of disorder in cases of intermittent pulse. We have gathered the fact, from direct and unmistakeable evidence, that the primary cause of the phenomenon is shock or debility of those nervous centres which are instinctive or emotional ; and if those centres be the ganglionic centres of the sympathetic system, it follows that they, and not the cerebral organs, are the original seats of the mischief. If they are not, then the prime mischief is situated either in the pneumogastric nerve or in the true nervous centres of the heart itself.

It will help us, in elucidating this part of our subject, to make

reference to the most modern view respecting the nervous mechanism of the heart, and this is that three sets of nerve structure concentrate on the heart and are concerned in its action, (*a*) the cardiac ganglia, (*b*) the supply from the sympathetic derived from the cervical ganglia of the sympathetic system, (*c*) the cerebro-spinal nerve, the pneumogastric or vagus.

What is the object of this elaborate nervous mechanism ?

The heart, a contracting and relaxing spiral muscle, is held by the nervous organization in the balance of two powers; or it may be more correct to say, the force liberated in the muscular structure of the heart is regulated by a balance of two nervous powers. The contractile act of the heart is *promoted* by the true cardiac nervous ganglia and by the supply from the sympathetic centres ; the contractile act is *controlled* by the inferior cardiac branches of the vagus. Hence when the vagi are divided, the action of the heart is for a time greatly accelerated ; while, when the vagi are irritated, the action of the heart is rendered slower, and may be even temporarily arrested.*

When the sympathetic cardiac supply is irritated, the action of the heart is for a time accelerated, and when the same supply is enfeebled the action is rendered slower, and I can induce intermittent action of the heart in inferior animals, pigeons and rabbits, by the simple process of causing deep narcotism with chloroform or chloride of amyl. When either of these agents is carefully administered so that it may induce deep sleep, although there may be in the early stages of narcotism very marked irregularity of the heart, there will be no intermittency until the last degree or stage of sleep has been attained. The brain may be narcotized until all its functions cease, the spinal centres may in like manner be temporarily extinguished, the voluntary muscles may be utterly paralysed, and yet there may be regular though slow action of the heart. At last there is heard, as the prelude to death, if the narcotism be continued, the intermittent action, precisely as it is detected in the human subject in those who suffer from intermittent stroke.

Falling back on our knowledge of the nervous mechanism of the

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* In the volume of the "Journal of Anatomy and Physiology" for May, 1869, the reader will find an admirable paper on the Function of the Pneumogastric Nerves, and the Motion of the Heart, by Professor Rutherford of King's College. The paper defines, more clearly and perfectly than any I have read, the nervous supply and nervous mechanism of the heart.

heart, we ask again, Where is the seat of the nervous lesion that causes intermittent action, and what is the nature of the lesion? It might be irritation of the pneumogastric in some part of its course, for irritation of the pneumogastric would cause slow action of the heart, and might momentarily stop action. It might be failure of power of the sympathetic cardiac supply, or of the true cardiac centres, for exhaustion of supply from the sympathetic and cardiac ganglia would create failure and cripple action. From all the evidence I have before me, I am led now to the view that the cause is failure of the sympathetic supply to the heart. As this view is corrective of the view I first advanced, in which the cerebral origin of the disorder was indicated, it is right I should briefly explain the reasons for this modification of opinion. The reasons are as follow :—

(1) A larger experience of the disorder has failed altogether to lead me to connect the phenomenon of intermittent action with any other symptom of cerebral lesion; such as paralysis of motion or sensation, convulsion, chorea, cranial pain, or any special symptom pointing to cerebral complication. I look over the records of the last fifty cases I have seen, and I find not a symptom of certain cerebral or spinal lesion. It seems to me almost impossible to assume that if the cause of the interruption of the heart were cerebral or spinal—if for instance there were disease implicating the pneumogastric at its origin—there could be persistency of the one symptom, and no sign of any other symptom of a cerebral nature.

(2) If the symptom were due to irritation of the pneumogastric in some part of its wandering course away from its origin, there would be afforded some very distinct evidence of the fact. There would be symptoms of pain, or of nausea, or of disturbance of the stomach, whenever there was disturbance of the heart. But on referring to actual facts, I find no indication whatever of any such necessary connection of symptoms. I infer therefore that in cases of intermittent pulse the pneumogastric is, as a rule, quiescent.

(3) The symptom of intermittent pulse does not appear to me to be dependent upon irritation and exaltation of function of nerve. In all I have seen of it, it has been connected with failure of nervous power, and with failure of the heart, not because the heart is arrested by any overruling force, but because it is not supported by a proper and efficient force.

(4) The evidence derivable from experiment with narcotics seems to me conclusive against the cerebral origin of the symptom, for it

is not in the stage of general muscular excitement, when the pneumogastric clearly is under excitation, that the symptom is demonstrated, but at the stage when the cerebrum is practically dead, when the muscles which are under cerebral and spinal influence are dead, and when nothing lives except the cardiac ganglia, and their reserve, the sympathetic cardiac ganglia.

(5) Further, the same experiment differentiates between the action of the sympathetic cardiac ganglia, and the true cardiac ganglia; for when the sympathetic fails in function, and intermittent action is developed, the cardiac centres still sustain a feeble action, even when all other nervous communication is cut off. Hence the failure does not lie in the true cardiac centres.

(6) The last reason for a modification of view respecting the seat of nervous lesion in cases of intermittency of the pulse, is, the strength of the proposition that the centres of the great ganglionic system are either the distinct centres of the emotional faculties, or that there is a direct connection between the sensorial organs and the sympathetic, so that emotions received through the senses are at once transmitted to the organic centres. It was demonstrated many years ago by the distinguished physiologist, Dr. Wilson Philip, that the ganglionic system can be excited to action through the sensorial organs without exciting the muscles called voluntary; and that when an impression which excites us involuntarily is received by the senses, it must pass through the involuntary nervous system to the involuntary muscles. Thus, change in the centres of the involuntary nervous chain may be excited by what is called mental impression, and central function may be destroyed as easily by such an impression as by a physical injury.

I look at the diagram of the organic nervous system and see there depicted the emotional brain. If we could put the organic ganglia and their nervous filaments, as a distinct system, side by side with the cerebro-spinal system, we should probably discern a system as extensive as the cerebro-spinal itself, the centres of which, subject to certain voluntary control, condense and regulate the force which is expended on instinctive and involuntary action.

Thus there is in every human being two nervous natures. The one primitive, impulsive, instinctive, propelling, sustaining, and probably capable of no immediate or direct education; a nature seated in the ganglionic centres. The other secondary, receptive, directing, controlling, and susceptible of direct education; a nature seated in the cerebro-spinal centres.

PLATE III.

DIAGRAM VIEW OF CENTRES OF ORGANIC NERVOUS SYSTEM.

We are all conscious of these two natures. We laugh or cry or move, instinctively, at something that affects or influences our organic system, and we control ourselves by an act of reason, or in other words an act of brain, and we say the thing was worth laughing at, or crying at, or moving for, or it was not worth it, as we say of a commodity we have bought, it was, or it was not, worth what we gave for it. Thus, like the centrifugal and centripetal forces, the two forces in our body act the one in subjection to the other; and if in any given case the emotional centres were to be excited to such degree that the controlling or cerebro-spinal organs lost their power, I see no reason why a person should not laugh or cry or move, under emotional impulse, until he died. In hysteria we see the effect of emotional impulse carried a long way towards death; in the dancing mania of the middle ages it was carried, in hundreds of cases, to the actual catastrophe of death.

And what is more, we are not only conscious of the two natures, but we refer the emotional nature to its true seat. We say of sorrow, "it sits heavy on the heart," and the glow of pleasure, or the gust of fear, are each immediately conveyed to us by sensations distinctly referable to the organic nervous centres, not to the reasoning brain, which at once endeavours to exert its controlling, its balancing power. And so intermittent action of the heart, as it is due to what may be considered accidental failure contracted during an intense emotional effort, or to senile failure of organic function, is traceable I think, fairly and logically, to failure of those centres of the sympathetic system which supplement the true cardiac centres in supplying contractile power.

Of the nature of the failure of the nervous centres we know as yet so little, that the best pathologist can scarcely speak with authority. Indeed, the whole subject of the morbid changes belonging to the ganglia of the sympathetic system is still imperfectly known. But from a physiological point of view, we may safely infer that each centre of the nervous system is a reservoir or receptacle of force derived, not merely from the blood with which it is fed, but also from the parts which the nerves entering it are said, incorrectly, to supply. In these centres, molecular changes, as yet, to us, imperceptible, may easily be understood as inducing deficiency of retaining power, and what is commonly called nervous debility and exhaustion, so that the centres cannot persistently carry on their allotted natural function.

It will add to the truth of the conviction I have put forward respecting the seat of disease in cases of intermittent pulse, to refer to an experimental truth adduced in my original paper. At the time when that paper was written and my mind was charged with the idea of the cerebral origin of intermittent action, I conceived it would be possible to induce intermittency by temporarily destroying cerebral function. I therefore entirely destroyed brain function by freezing the hemispheres in an inferior animal, but, although by this method the most complete insensibility was induced, there was no satisfactory indication, as I then reported, of intermittent motion of the heart. I thought this result was due to the circumstance that the parts at the base of the brain had not been affected. But I have since found that if an animal be rendered insensible by exposure of the whole cerebrum to extreme cold, there is no intermittent action: if however in this state the animal be allowed to inhale vapour of chloroform the intermittent action is at once set up, the ganglionic organic centres being now involved. At the same time, the ganglionic system may be influenced by some physical injuries of the cerebral surface, without the least implication of the voluntary nervous system: this is occasionally seen in cases of concussion; and I have twice known intermittent pulse follow upon injury of the head from a fall; once also I knew it succeed symptoms of an apoplectic character, in which the patient suddenly fell forward without warning, and remained insensible, with indications of pressure, for several hours.

The recent researches of Waller, Rutherford, Wood of Philadelphia, and others, on the functions of the pneumogastric, deserve, finally, a word. It has been so clearly demonstrated that irritation of the pneumogastric produces what is called "slowing" of the action of the heart, the inference seems to come naturally that intermittent action is or may be a result of such irritation. But direct observation does not support this view. When the pneumogastric in the neck is subjected to irritation, the action of the heart is lowered and there are induced signs of faintness, and what Waller calls asthenia. Waller has in fact induced temporary faintness in the human subject by mechanical irritation of the pneumogastric, for the purpose of aiding in the reduction of dislocation.* But from what I learn from observation on the inferior animal, the same irritation, while it produces symptoms of faintness and asthenia, does not

* Proceedings of the Royal Society, May, 1870.

produce the intermittent cardiac action which is now under our consideration; and, what is equally to the point, patients suffering from intermittent pulse are not necessarily subject to symptoms directly indicating irritation of the pneumogastric.

I repeat therefore my present conviction, as I close this section of the subject, that the seat of the nervous lesion is in the nervous centres which supply the reserve contractile power of the heart, I mean the sympathetic nervous centres that go to feed the heart, and that the change in those centres, whatever it may be physically, leads to their failure as reservoirs or condensors of force.*

ON THE SIGNIFICANCY OF INTERMITTENT PULSE.

In itself, when it is not present in an exaggerated degree, intermittency of the pulse is less dangerous than it seems. It does not, as might be feared, carry with it the necessary idea of sudden dissolution from heart disease, for, as I have elsewhere shown, the heart is the regulator, not the prime mover, of the circulation. The harmlessness of the symptom in its moderate development is best shown by the facts of its common occurrence after middle age, and the long duration of life in many of those who present it.

At the same time the symptom has its significance. Occurring in infancy, it is an important indication of the existence of serious nervous derangement. Occurring in adults it has the same meaning, and tells the story of commencing failure of power. Occurring suddenly after any great event which has told upon the mind, it may be a sign of serious import. My own experience connects it as the first physical indication of derangement in three cases of disorder of mind in which suicide was attempted, in two of the cases successfully. Further, it becomes an embarrassing sign in all conditions where there is diminished condensation of force in the nervous centres, where force is either not laid up or is given out too freely.

* I must not allow this paper to leave my hand without acknowledging a work indifferently known, and yet full of the most suggestive and original thought. I refer to the work of Dr. Davey, of Northwoods, Bristol, on "The Ganglionic Nervous System." Dr. Davey has most clearly appreciated the functions of the organic nervous centres, and has described his views in a volume which, when the jealousies, prejudices, and ignorances, that always beset the present, concerning the present, have passed away, will be discovered by some future and unbiassed scholar as a neglected classical work of the physic of the nineteenth century.

In persons advanced in life, and in persons prematurely old, intermittency is often the herald of symptoms of nervous failure. In these examples the patient has sometimes a singular preconception of impending danger: he is seized without reason with what I once heard a patient call "panic." These also are cases of very serious import. The symptom may again be increased until it lapses into veritable and fatal disorder, from continuance of morbid change in nervous matter.

In the large majority of patients there is an unconsciousness of the intermittency. We listen to the heart, we hear the phenomenon distinctly, and we ask the patient, at the moment, whether he is conscious of anything peculiar, and he tells you he is not. In such instances the intermittent phenomenon does not cover more than what would be one or at most two normal periods of cardiac contraction, and there is a long interval before the return of it. But when the intermittency covers a period equal to five normal strokes, or when it is repeated in shorter periods, several times in the minute, then the patient is painfully, often fearfully, conscious of the fact. Then breathing becomes irregular, then there is difficulty in keeping the recumbent posture, then there is sleepless agitation, terrible mental depression, a constant dread of death, sometimes with a singular longing for that event, and finally death itself, not suddenly, but by a lingering and sinking asthenia. These are true cases of what has been poetically called "broken heart."

I have seen one well-marked case, already referred to, in which it was impossible to attribute death to any other cause than intermittent cardiac action, and I do not remember any case where the symptoms, which long preceded death, were so acutely painful. The heart intermitted in this patient, ten, and even twenty, times in the minute, and some intervals of hesitation were so prolonged that sense of faintness and impending death tormented the sufferer. He feared to lie down, since that increased the evil; he feared to sleep, for the same reason; and as he got weaker from pain and broken rest, the intermittency itself became intensified, despite all our efforts, until death came to bring the only possible relief.

A case such as is here related is, truly, extreme and rare, and I do not adduce it as suggesting undue alarm respecting intermittent action. I would give to the symptom its just value, and no more. Whenever it is persistently present in any person, the actual value of life as compared, *cæterus paribus*, with the life of another person

who has no such symptom is reduced; the power for work is less, the power to meet extremes of heat and cold is less, and the power to meet the anxieties and calamities of life is unquestionably much less. The man or woman with a hesitating heart is thereby unfitted for sudden tasks, demands, resolves, which, when the heart is firm, are considered as of comparatively little moment; for when the heart hesitates. the brain, which reposes for its power on the blood the heart supplies to it, falters with the heart, just as the gas flickers when the steady pressure is taken off the main. From these circumstances some persons who once were known as resolute and determined, lose those qualities when they are subjected to intermittent action of the heart, becoming, as their friends say, uncertain and doubtful in character; becoming, as they themselves feel and know, less the masters of themselves, and less secure in their own work, and skill, and power.

Another point is worthy of note. Persons in whom there is permanent intermittent action of the heart pass through all acute diseases with less chance of recovery than others of similar age and like constitution who have no cardiac failure. They sink more readily from surgical operations, from falls and injuries, from influenza, from acute congestion of the lungs, from inflammatory attacks, and peculiarly from typhus and typhoid fever. I would look upon a man's chance of recovery from typhoid if he were fifty years of age as preferable to that of another man at forty in whom intermittent action of the heart was developed before the occurrence of the disease, or in whom the symptom came on, as it sometimes does come on, in the course of the disease.

Such are the principal facts conveyed to the mind when the phenomenon of intermittency of the pulse is before the practitioner. The phenomenon is truly to be reckoned only as one symptom, and I would in no sense exaggerate its importance. At the same time, in severe justice, it is correct to say of it that the person who presents it, though he may live long, is of infirm body; that his cardiac mechanism is out of tune; that if ever his heart should be called upon for a great effort, it will not be prepared for the effort; and that if ever, from mental strain or pressure, his heart is strained, it will succumb more easily than it ought naturally to succumb to the resistance put upon it.

Thus the phenomenon, symptom though it be, is of moment; it is of such moment that if two men, of equal age, build, education, and power, were put into contest, mental or physical, and the one

had, and the other had not, intermittent pulse, the chance of success is altogether in favour of the man whose heart is not intermittent. In like manner if two men of equal apparent build had to contend with a surgical operation, a disease, or a given equal amount of anxiety, the values of resistance are beyond measure in favour of the man whose heart is not intermittent.

The phenomenon has therefore its general meaning, both for the physician and the surgeon. It has also its particular meaning, since it may be raised into fatal consequence by disorders which need not, in its absence, prove fatal.

ON THE PERMANENCY OF THE SYMPTOM.

In children the symptom of intermittency of the pulse may pass away with growth and increase of strength; in adults, when the symptom is once established, it never, I believe, goes away entirely. It may be absent for long periods when the general health is good, but it returns on every occasion of depression of power, and is very easily induced by agencies which act deleteriously on the nervous system. Excessive venereal gratification, excessive smoking, deficiency of sleep, and dissipation, act powerfully in increasing the evil. In persons at or past middle age, the symptom, if it once be fully developed, continues persistently, and often to extreme old age. One of my patients, who died at eighty-six years of age, told me he had been discovered to have an intermittent pulse when he was forty-two, and that he had never failed to exhibit the phenomenon since that time.

POINTS OF PRACTICE.

There is no known specific treatment for intermittent heart, but, whenever the symptom of intermittency is present, there are certain general lines of treatment which should always be enforced by the physician.

(1) In the case of young children, when the intermittency is clear, however infrequent it may be, the utmost care should be taken to avoid every source of mental excitement. A child having intermittent pulse should not, under any pretence, be oppressed with study. He should not be subjected to any amusements which powerfully excite the mind; he should not at any time be exhausted by physical fatigue; he should be well fed, warmly clothed from head to foot, and, above all things, should be allowed to have abundant

sleep. Ten to twelve hours' sleep is not a moment too much. Moreover, such a child should never be put to sleep with stories which excite dreams or cause alarm.

(2) In adults equal care should be taken, and, above all things, attempts should be made to remove impressions derived from any untoward event. Change of scene should be recommended, while a carefully regulated diet, abstinence from exhausting pleasures and abstinence from exhausting labour, especially mental labour of any one particular kind, should be encouraged. Good sleep is here again the most valuable of remedies. Eight hours of sleep out of the twenty-four are essential, nine hours are still better. Two other special points of advice are of moment. It not unfrequently happens that, by accident or by direct information, patients learn the fact that their pulse intermits. Then they begin to feel their own pulse, and become charged with dread of sudden death. As the disorder is of itself mental, this watchfulness and fear will increase the frequency of the intermittency. With these patients, a word from the physician timely and firmly spoken is often the best prescription. He assures them on the results of experience that their malady is not of necessity fatal; he commends them not to enquire after the symptom, and if he can succeed in persuading them to his views, which he may honestly try to do with all his influence, he will effect the most marked improvement in their condition. Again, it sometimes happens that patients conscious of the failure of the heart resort to alcoholic stimulants as a means of relief. For a moment, by its exalting the activity of the heart, alcohol affords relief, but the depression that follows calls the more rapidly for a return to the supposed remedy, and a fictitious benefit leads to a habit which excites structural changes and hastens death.

(3) In cases of sudden intermittency, with symptoms of cerebral congestion, depletive measures are sound. A purgative is essential, and blistering at the back of the neck is always useful. I have seen also great advantage in these cases from abstraction of a moderate quantity of blood by the cupping glasses.

(4) In chronic extreme forms of cardiac intermittency, while all the general rules laid down in Nos. 1 and 2 hold good, it becomes often imperatively necessary to subdue nervous excitement, and to induce rest. For this latter purpose, opium is the sheet anchor. It must be given freely when it is given, and not too frequently. Small and repeated doses of opium excite, depress, and give no

rest. A full dose, equivalent to a grain or even two grains, produces, on the contrary, no excitement, but gives sound sleep and that quietude of circulation which is essential to secure a satisfactory relief. I have sometimes, where there was much depression, combined opium with full doses of quinine with marked benefit.

(5) Concerning old people who suffer from what may be called chronic intermittency without oppressing symptoms, no special rule requires to be laid down. They are themselves usually too tired of the excitements of life to care for them, and if they are not, then the observance of the general principles applicable to children and adults extends equally to them.

The above general rules of practice, written in 1868, hold good, and require no modification: but I have since learned a few details of practice which are useful and which deserve to be added in this chapter. In the first place, whenever with intermittency of the pulse there is anæmia with atonic condition of the bowels, and distention of the stomach and intestines with gas, it is very good practice to add, to the general rules of treatment, a tonic so called, and of all tonics Easton's Syrup of the Superphosphate of Quinine, Iron, and Strychnine, is the best. This syrup, which contains the thirty-second part of a grain of strychnine in a fluid drachm, should be administered in doses of a drachm three times daily, a little time after food, and the patient should be induced to look upon the remedy in the light of a food rather than a medicine. It may be continued for two and three months at a time, without danger, under the careful observation of the practitioner.

In some cases of intermittent pulse I find a tendency to periodical neuralgia. Sometimes the neuralgia attacks the nerves of the face, sometimes the sciatics, sometimes the pneumogastrics. When this symptom is present the intermittent action is intensified; not I believe from any direct connection between the neuralgic pathological state and the irregular action of the heart, but from the broken rest and anxiety which the neuralgic pain induces. In these cases, in addition to Easton's syrup, which still maintains its position, quinine in free doses—two to five grains—is required, together with morphia when it is necessary to procure sleep by artificial means. Hydrate of chloral is also useful in this class of cases, but I do not find it is better than morphia. I have, lately, sometimes combined the hydrate with morphia with advantage.

There are classes of cases in which intermittent pulse is connected

with great general prostration and premature breaking up of the body: cases in which there is some organic disease, such as chronic bronchitis, emphysema, senile phthisis, cirrhosis, disorganization of the kidney, or other organic change; or some general systemic disorder, such as diabetes or cancer. In any of these cases the intermittent action is a terrible addition to the distress of the sufferer, and it may require to be treated itself as the worst present evil. In these circumstances, with an occasional alterative, I find the following compound of most service for the intermittency.

Mixture of Iron, Morphia, and Ammonia.

Sulphate of iron, grs. xxx.
Carbonate of potash, grs. xxv.

Rub together dry into a fine powder; pour on distilled water in small quantity so as to make a thin paste, and when the green carbonate of iron is formed, add—

Bicarbonate of ammonia, grs. xxiv.
Solution of hydrochlorate of morphia, ʒ ss.

Finally add—

Proof alcohol, ℥j.
Pure glycerine to ℥iij. Mix.

Of this mixture the dose is from two to three fluid drachms, which dose may be taken three or four times in the twenty-four hours. I know of nothing that gives such speedy relief to the intermittent action, or that more strictly acts in the sense of a "tonic," than this mixture.

I have made many enquiries in order to ascertain if there be any one particular remedy which so influences the nervous mechanism of the heart as to exert an immediate controlling effect over intermittent action; and the result of my research is that there is only one agent which can be said positively to influence it, I mean to influence it at once in such determinate manner that an effect is seen to follow upon a cause. The agent to which I refer is alcohol, and the mention of alcohol brings up the whole question of its use in cases of intermittent action.

It has been long known that the direct physiological action of alcohol is to quicken the motion of the heart, and Dr. Parkes and Count Wollowicz, in an admirable paper published in the Proceedings of the Royal Society for May 1870, have demonstrated that in a healthy man the daily increase of the beats of the heart under alcohol, as compared with the number of beats when water is the

only beverage, is rather more than thirteen per cent. The results obtained by these authors are so curious and important that I subjoin them, verbatim, in a foot-note.*

In intermittent pulse this direct action of alcohol on the heart is shown with singular effect. I have seen in an extreme case, where the fact of intermittency was recorded ten times in the minute at least, a total cessation of the phenomenon within five minutes after the administration of an ounce and a half of sound brandy, the circulation at the same time being rendered more rapid. This action of alcohol is so decisive that the patient himself soon becomes conscious of it, and perchance resorts sometimes to the remedy, as if by instinct, to his ultimate disadvantage. Here then we have an agent which for the moment gives relief to the symptom. It does not cure, but it relieves: it does not now act as a narcotic, for intermittent action of the heart, a symptom not of excitement, nor of irritation, nor of over-action, but of failure of nervous power, is not directly relieved by a narcotic; but it stimulates the flagging power. The question therefore arises—To what extent is alcohol

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*"The average number of beats of the heart in 24 hours (as calculated from 8 observations made in 14 hours), during the first or water period, was 106,000; in the alcoholic period it was 127,000, or about 21,000 more; and in the brandy period it was 131,000, or 25,000 more.

"The highest of the daily means of the pulse observed during the first or water period was 77·5; but on this day two observations are deficient. The next highest daily mean was 77 beats.

"If instead of the mean of the 8 days or 73·57 we compare the mean of this one day, viz. 77 beats per minute, with the alcoholic days, so as to be sure not to over-estimate the action of the alcohol, we find:—

On the 9th day, with 1 fluid ounce of alcohol, the heart beat 4,30 times more.
On the 10th day, with 2 fluid ounces, 1,872 times more.
On the 11th day, with 4 fluid ounces, 12,960 times more.
On the 12th day, with 6 fluid ounces, 30,672 times more.
On the 13th day, with 8 fluid ounces, 23,904 times more.
On the 14th day, with 8 fluid ounces, 25,488 times more.

"But as there was ephemeral fever on the 12th day, it is right to make a deduction, and to estimate the number of beats in that day as midway between the 11th and 13th days, or 18,432. Adopting this, the mean daily excess of beats during the alcoholic days was 14,492, or an increase of rather more than 13 per cent.

"The first day of alcohol gave an excess of 4 per cent., and the last of 23 per cent.; and the mean of these two gives almost the same percentage of excess as the mean of the 6 days.

useful as a remedy for intermittent heart? This is a very delicate and difficult question to answer; for unfortunately the remedy itself, if carried too far, increases, after a time, the primitive evil, and as it is a remedy always at hand and viciously pleasant, its bad rather than its good influence is the most probable event. The advice I have to offer on the matter is nevertheless simple, simple because it has been learned by repeated experiences in many cases, and because the results from it are very uniform. I recommend all who suffer from intermittent pulse to abstain from alcohol in every shape as far as is possible, and resolutely to abstain from every alcoholic fluid respecting the character of which there is the merest doubt. There are some fluids, such as champagnes, sweet ports, and even light acid wines,—clarets, burgundies, hocks,—which, so soon as the short stimulating action they produce has passed away, induce great prostration, with marked increase of intermittent action, if they have been taken in any free quantity. All these must be avoided. Objections may also be taken to rum and gin. A person with intermittent pulse is in short brought to the use of three ordinary alcoholic drinks—sound light ale, sound light sherry, and sound brandy the

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"Admitting that each beat of the heart was as strong during the alcoholic period as in the water period (and it was really more powerful), the heart on the last two days of alcohol was doing one-fifth more work.

"Adopting the lowest estimate which has been given of the daily work done by the heart, viz. as equal to 122 tons lifted one foot, the heart during the alcoholic period did daily work in excess equal to lifting 15·8 tons one foot, and in the last two days did extra work to the amount of 24 tons lifted as far.

"The period of rest for the heart was shortened, though perhaps not to such an extent as would be inferred from the number of beats; for each contraction was sooner over.

"The heart, on the fifth and sixth days after alcohol was left off, and apparently at the time when the last traces of alcohol were eliminated, showed in the sphygmographic tracings signs of unusual feebleness; and perhaps in consequence of this, when the brandy quickened the heart again, the tracings showed a more rapid contraction of the ventricles, but less power, than in the alcoholic period. The brandy acted, in fact, on a heart whose nutrition had not been perfectly restored.

"The peripheral circulation was accelerated and the vessels were enlarged; and the effect was so marked as to show that this is an important influence for good or for evil when alcohol is used.

"Referring only to this healthy man, it is clear that the amount of alcohol the heart will bear without losing its healthy sphygmographic tracing is small, and it must be supposed that some disease of heart or vessels would eventually follow the over-action produced by large doses of alcohol."

strength of which is known. As a rule, I do not find that any harm follows a moderate use of sound light ale, provided the quantity taken do not exceed three half-pint glasses a day; or, if sherry be preferred to ale, I do not, as a rule, find harm resulting from three wine-glasses of it in the day: but beyond these measures all is hurtful. As to brandy, although I have mentioned it as allowable, it must be considered only as a reserve force, to be called in when there is real and urgent necessity for it, and then in a moderate degree. If after great fatigue or excitement or anxiety, there is sleeplessness, restlessness, and painful knowledge, on the part of the patient, of the hesitation of the circulation, half an ounce or an ounce of brandy will act, generally, in the most effective manner. It will bring rest at once, and, often when a narcotic fails, sleep: but it must be repeated only after an interval of seven or eight hours; if it be carried to the extent of producing the third, paralysing or narcotic, degree of alcoholic stimulation it will have conferred evil instead of good.

I have suggested the above method of administering alcohol, because it is practical and is most likely to fall in with the ordinary mode of life of the majority of patients. But persons who object to alcohol, and these are daily increasing, need not have the agent pressed on them, except in extreme circumstances where the dose is needed in the true medicinal sense. In the medicinal sense it is best to prescribe absolute alcohol, ordering it in half the proportion of the best brandy. Half a fluid ounce to six fluid drachms will be sufficient in four ounces of water, to which may be added ten grains of bicarbonate of potash or twenty minims of sal volatile if there be acidity of stomach or eructation.

In some instances, instead of prescribing common or ethylic alcohol, I substitute pure methylic alcohol. This is a much lighter spirit, and is eliminated more quickly from the body. The dose is the same as for common alcohol and may be prescribed in precisely the same way, with the advantage that it may be more frequently repeated than the same dose of ethylic alcohol.

I think I have now said all that needs be said respecting the use of alcohol in intermittent heart. I have expressed a fact, a practice, and a caution. The fact, that alcohol by its stimulant action on the nervous mechanism of the heart will temporarily remove intermittent action. The practice, that in extreme cases and at extreme crises, alcohol may be advantageously prescribed to relieve the symptom. The caution, that in prescribing alcohol it is never

necessary to let the occasional glide into the habitual practice of taking it, the tendency of the remedy being, when it is often and systematically repeated, to increase the primitive disorder.

It is better that a patient who suffers from intermittent pulse should not smoke tobacco. It has been assumed by some that tobacco may even induce intermittent action, and I have seen one or two cases which would engender a suspicion that both smoking and snuff-taking might be set down as causes. But longer observation tells me the suspicion is not correct. If the practices named were true and independent causes of the phenomenon, we should find, frequently, cases in the male sex where the cause stood alone, and we should also find the phenomenon much more common in men than in women. In truth, however, I have never seen a *pure* case of intermittency from tobacco; neither have I been able to discover that the male sex is specially liable to the affection. At the same time, it is unquestionably true, that, when the symptom is developed, smoking and snuffing intensify it; not, I think, from any special influence, but from the general debility induced, the steady indigestion which the narcotic sustains, and the restless muscular action—tremor—which it favours and supports. Tobacco, in a word, acts like other depressing agencies, such as loss of blood, or want of sleep, or deficient food, or bad assimilation of food: it injures as a secondary cause; it does not produce from the first.

In men who chew tobacco, and in men and animals under the direct poisonous influence of nicotine, I have watched for the symptom of intermittency of the cardiac motion without result. The action of the heart may be feeble and irregular, the muscles in a state of restless tremor, and the body cold. But there is no pure intermittent action. The symptoms from nicotine are those of cardiac apnœa; of failure of the right rather than of the left side of the heart, with difficult respiration; and, in man, spasmodic pain passing through the thorax, from the sternum to the crura of the diaphragm. A marked case of this kind is recorded in the essay on cardiac apnœa in my "Asclepiad."

The remarks made in reference to tobacco apply equally to tea. Tea does not produce intermittent heart, but when the symptom is present it very seriously increases it: tea, in short, is an article of diet which in all cases of irregular action of the heart should be scrupulously avoided. Coffee is less objectionable.

In respect to the diet of persons suffering from intermittent pulse little in the way of special rule can be said, because in each case

there is commonly some other functional organic disorder which calls for special attention, the intermittency remaining as a systemic failure rather than as a distinct malady. But one general remark applies to the general condition; viz. that food should be taken by sufferers from intermittent action in moderate quantities and *frequently*. Long fasting is unspeakably prejudicial, and makes itself speedily felt by the patient, who writhes, while fasting too long, under an indescribable exhaustion, which is not hunger and not faintness in the natural sense of those terms, but a strange mixture of both sensations with a frequently recurring impression that if food do not immediately come death must. The nervous supply of the heart, in these cases, is sensitive of the least failure of power, and requires renewal every three or four hours during the working day. At the same time it rebels against a large, hardly digested, and oppressive meal.

One note more occurs to me respecting meals. There is a common feeling against *late* meals, late dinners or suppers, and I have no intention of opposing that which is not only a common, but, as a rule, a natural and correct objection. Experience however tells me that to retire to rest with the body fasting is as bad a practice as to retire with the stomach busily digesting. A light meal taken an hour or two before sleep is, I think, good for everyone, and it is essential for those who suffer from intermittent action of the heart. The last meal should certainly not be large, and should consist of some very simple easily digested food, such as milk, or cocoa, with bread and butter, or some similar food, tea being specially excluded. In extreme cases of intermittent action it is also good practice to let the patient have a glass of milk, or of milk diluted with water, at the bedside during the night. The period of the approach of the early morning, the hours between two o'clock and the dawn of day, is a period when the strongest are at their weakest, and the weakest at their worst; and so it commonly happens that the very weak die in the hours named. In the same hours persons who suffer from feeble and intermittent cardiac action commonly become restless, wake with sensation of exhaustion, and, if they are not sustained, sleep afterwards indifferently. At this period the reserve of food I have suggested is the best remedy; it relieves the exhaustion and restlessness, and ensures return to a sleep undisturbed by dreaming melancholy, and from which waking is the taste of the refreshment of sleep that has been bestowed.

A word as to warmth and clothing and I have finished what I

have to say on points of practice. Persons who suffer from intermittent action of the heart, whether they be young or old, should at no time expose themselves to loss of bodily heat. They should not, for example, take cold baths, nor shower baths, but should in every habit study to follow a medium course. In every season the body should be so clothed that sensation of coldness shall not be felt. Flannel should be worn next the skin at all times: thin flannel in hot, thick in cold weather. Care should be taken also to protect the body from damp and wet. In a word, every such provision should be made as will sustain equality of vital process, so that the disabled heart may neither wait long for new support, nor be taxed with labours it cannot, at its best, fulfil.

ON PALPITATION OF THE HEART.

Connected with the subject of intermittent action is that of palpitation of the heart. I believe that all persons who suffer from intermittent pulse have attacks of palpitation, but some persons have palpitation who are not liable to intermittent motion. The symptom of palpitation is not always well defined, nor is it at all times defined in the same terms. One calls it a fluttering of the heart; another, a fluttering within the chest; a third, palpitation or throbbing. The symptom moreover is not uniform in character. At first it is noticed as if proceeding from the stomach and ascending the throat, giving a singularly unpleasant tickling sensation in the back of the throat, with fulness. Exertion after meals is a common apparent cause of this palpitation, which, though comparatively devoid of danger, is still often a disagreeable and even alarming condition to those who have to endure it. After a time other symptoms occur, and are embarrassing. On lying down to sleep there is disturbed action or movement in the chest, with over-action of the heart, so that the action can be heard loudly through the pillow; and this is followed by frequent twitching in the muscles of the limbs, of the lower limbs especially. In most instances of this character the limbs actually move as if under the influence of a galvanic shock, and with the movement, or immediately preceding it, is a painless movement in the chest, as if from a jerking act of the heart itself. During this condition the motion of the heart may be actually intermittent, but the jerk I speak of is distinct from intermittent action. All the time through there is no pain, and I may add that all the time through there is no spasm. In this point of view the paroxysm of palpitation differs from a paroxysm of cardiac apnœa.

Physiologically, the motor tracts only of the nervous organism are deranged. After a longer or shorter period sleep comes on, at first perhaps starting and disturbed sleep, but anon quiet; with the quiet, and with placid sleep, all the signs of irregular muscular motion disappear.

In persons strongly disposed to the form of palpitation now described, it is remarkable how small a matter will excite a paroxysm in the latter part of the day; late hours, indulgence in strong tea, indulgence in tobacco, too hearty a supper, these all tend to bring on the irregular action and the sleepless disquiet. But that which induces the nervous symptoms most readily is emotion or continued mental exertion; either of these, especially at the hour of rest, are peculiarly provocative of the mischief of which I now speak. Some *amusements* of the evening, even, lead to this disturbance. Chess is a game very bad for a late hour; played earnestly and intelligently, it calls special faculties into undue action at the expense of other faculties; it leaves active faculties at work; it leaves, that is to say, some of the cerebral centres still thinking, and these, like troublesome, noisy companions, are fatal to repose. In a lesser degree, and with irritable persons in as great a degree, late whist is bad. Nay, I know of nothing worse than quarrelsome whist with the stake high. A game of this kind may be ended, but hours will pass before the dissatisfied and quarrelling mental organs within the player will arrange terms and settle down. Reading late in the night and reading aloud are especially mischievous.

The worst mischief of all is the practice of carrying to bed the anxieties and annoyances of the labours of the day. I believe that more than half the cases of palpitation of the heart occur from this one mistaken and foolish practice. It is a practice from which success can never follow, for the organ that must work must rest, and if it do not rest diurnally its proper time, it will rest annually in time to come—*i.e.*, it will die while the rest of the organism lives, and then there will be physical anarchy, disease of the mind's kingdom, one of the great estates defunct, and the balance lost.

The condition of the heart when it palpitates is not greatly different from what occurs during intermittent action: that is to say, if the palpitating organ be submitted to auscultation there will be heard a quick repetition of second sounds with an occasional first sound. The sounds may run sharply thus:—
Lūb dúp 0. Dúp dúp 0. Dúp dúp 0. Lūb dúp 0. Dúp 0 dúp.

Lūb dúp dúp. Lūb 0 dúp. Dúp dúp 0. Lūb dúp 0. The motion of the heart is at first extremely rapid, and the first indication of recovery from the disturbance of balance is slowing of the heart.

The influence at work in producing *cardiac* palpitation is akin to that which produces intermittent movement, but the change is functional and temporary. It consists of sudden excitement or irritation of the organic nervous ganglia which supply the heart. When the vapour of nitrite of anyl is inhaled for a few seconds it has the effect, even in strong persons, of exciting the organic ganglia; and quick, vehement, and palpitating action of the heart is the immediate result.

There is another kind of tremulous action, felt as if within the chest, which is commonly called palpitation of the heart, but which is not seated in the heart at all: some of the older writers named this *epigastric* palpitation, and as it deserves to be well known I refer to it specially. I had read of the symptom, but had not been forcibly impressed with the lesson, until I met with a direct observation from nature which made me curious to know more.

One of the most eminent of living men in physical science first pointed out to me the fact that even severe palpitation may not be cardiac, "because he knew he himself constantly had palpitation when his pulse was quite steady and slow." As I doubted the correctness of his observation—for he was the subject of intermittent pulse—he one day rode up to me from his club, "Now," said he, "I have unbearable palpitation, you can see it through my clothes, and it makes me feel faint, but it is distinct from the intermittent action of my heart, and from the actions of my heart or pulse at the wrist, as you will find." His observation was accurate; his heart beat seventy-four times a minute, with intermittent action every twenty-sixth stroke, and his wrist pulse tallied, but the motion of the heart was tranquil and entirely distinct from the rapid vehement palpitation. The palpitation was from some pulsating action immediately below the heart; it was epigastric, and had no relation to motion of the heart.

I have, since this case, very often examined the chest in other persons during palpitation, and found the same fact, viz. tumultuous action or fluttering felt as if within the chest, without any actual disturbance in the motion of the heart. This palpitation is usually accompanied with a sense of fulness in the throat, and is relieved by the eructation of flatus, or by the passage of gas along the small

intestines into the colon. The pulsation can be felt by the observer very distinctly, and it can also be heard through the stethoscope, but not always in exactly the same place. It is usually most distinctly heard in the epigastric region, centrally, a little below the lower point of the sternum : it consists of a series of quick throbs, very full and bounding, sometimes with faint murmur. In my first communication on this symptom I thought it was due to a tremulous rapid movement in some of the fibres of the diaphragm, but further experience has proved to me that the pulsation is really vascular, and that it is due to motion in some of the large vessels which proceed from the aorta to feed the abdominal viscera, such as the cœliac axis. It is as if the nervous supply to the vessel were rendered in an irregular or disturbed manner, and that the vessel underwent a rapid series of contractile movements, independently of the cardiac movements. Epigastric palpitation is rarely prolonged, and, although it is painfully disagreeable, it is not, alone, of serious moment. It is less commonly connected with intermittent action of the heart than is the true cardiac palpitation.

The treatment of that form of palpitation in which the motion of the heart itself is involved is the same as that which holds good for intermittent action. The palpitation which may be called epigastric, is also properly treated on similar principles ; but when it is present it is more important to attend to the digestive functions: to administer an alterative aperient ; or an alkaline bitter, if there be acidity ; or a mineral acid—nitro-hydrochloric—if there be inactivity of hepatic function. When the symptom is connected with anæmia, with want of muscular tone, and with deficient action of the bowels from feebleness of muscular power, the Syrup of the Superphosphate of Iron, Quinine, and Strychnine, is, with an occasional alterative, the best of all medicinal aids to cure.

III.

COMMUNICATIONS ON GENERAL AND SOCIAL SUBJECTS.

NOTE.

In my recent official visits to St. Andrews as Assessor of the General Council of the University, I have learned with special interest the advantages which our ancient University offers to students who are desirous of obtaining an education learned, inexpensive, free from sectarian influence, and encouraged by those rewards for industry which so materially lessen the anxieties of University life.

The city of St. Andrews as a residence for students leaves nothing to be desired. It is on the sea coast, about fifty feet above sea level, and is as beautiful as it is healthful. The society of the place is in the strictest sense conducive to the moral welfare of the scholar, and the Professors are wholly and earnestly devoted to their educational work.

What has been to me new information will, I doubt not, be also new to the majority of Graduates whom I have the honour to represent in the University Court. I have therefore, with the hearty approval of the Council of the Association, asked Dr. Sedgwick to compile for our Transactions the following account of the University and its educational resources.

B. W. RICHARDSON, M.D., F.R.S.

EDUCATION AND GRADUATION AT THE UNIVERSITY OF ST. ANDREWS.

HISTORY.

For long before the foundation of the University, in the earliest part of the thirteenth century, the city of St. Andrews was widely known as a great school of religion and learning.

In A.D. 1411 the University of St. Andrews, the most ancient in Scotland, was founded by Bishop Wardlaw. The foundation was sanctioned in A.D. 1413 by a Bull of Pope Benedict XIII. Under the authority of this Pope the University was instituted for instruction in Theology, Canon and Civil Law, Medicine, and the Liberal Arts, and power was granted to confer degrees on such students as the Bishop might, after due examination and advising with the Doctors and Masters of the University, deem to be worthy of them.

In A.D. 1455 Bishop Kennedy, who succeeded Wardlaw in the see of St. Andrews, founded, under a charter from Pope Nicholas V., the College of St. Salvator. The privileges of the College were extended in A.D. 1458 by Pope Pius II., and subsequently in A.D. 1468, by Pope Paul II., who granted the power of conferring degrees in Theology and Arts.

In A.D. 1512 St. Leonard's College was founded by John Hepburn, Prior of the Augustine Monastery, and Archbishop Stuart.

In A.D. 1537 Archbishop Beaton, uncle of the cardinal, with the sanction of Pope Paul III., founded the College of St. Mary on the site of Bishop Wardlaw's original buildings. This College was completed in A.D. 1553 by Archbishop Hamilton.

The three Colleges remained distinct until A.D. 1747, when the two Colleges of St. Salvator and St. Leonard were united by Act of Parliament.

The University now consists of the United College of St. Salvator and St. Leonard, devoted to the Faculties of Arts and Medicine, and the College of St. Mary, devoted to the Faculty of Theology.

FACULTIES.

ARTS.

The only degree granted in this faculty is that of Master of Arts (M.A.)

The ordinary course of study for the degree of M.A. extends over four sessions, and includes attendance for not less than two sessions on the classes of Humanity, (Latin,) Greek, and Mathematics respectively, and for not less than one session on the classes of Logic, Moral Philosophy, Natural Philosophy, English Literature, and Chemistry respectively.

There are two classes, Senior and Junior, in Humanity, (Latin,) Greek, and Mathematics; and if a student on entering the University passes a sufficient examination in any of these subjects, he may at once enter the Senior Class of such subject.

If the student is, on examination, admitted on entry to the Senior Class in both Latin and Greek, the course of study needed for the degree of M.A. may be completed in three years.

The examinations for the degree of M.A. are three, viz. :—

I. Latin and Greek.
II. Logic, Moral Philosophy, and English Literature.
III. Mathematics and Natural Philosophy.

The examinations are partly in writing, and partly *vivâ voce.*

These examinations may be passed at three separate times, in any order, when the student has attended the required number of classes for each.

Having passed any one of these examinations, the student is not again examined on the same subject; and on passing the three examinations, he is entitled to receive the degree of Master of Arts at the public ceremonial of Graduation.

If a student desires to graduate with honours, he may present himself for further examination in one or all of the following departments, viz., Classical Literature; Mental Philosophy; Mathematics; and Natural Science.

The fee for the examination for M.A. is three guineas.

There is no limitation as to age, and no declaration of faith is required.

MEDICINE.

The degrees granted in this faculty are Bachelor of Medicine (M.B.), Master in Surgery (C.M.), and Doctor of Medicine (M.D.)

Degrees in medicine may be conferred on those who have complied with certain regulations common to all the Scottish Universities; but as one of them provides that two of the four years of medical and surgical study shall have been spent in a University of the United Kingdom, and as the University of St. Andrews possesses no medical school, it is practically excluded from the education of students in medicine.

Degrees in medicine may also be granted in accordance with the following regulation peculiar to St. Andrews.

The degree of M.D. may be conferred on any registered medical practitioner above the age of forty years, whose professional position and experience are such as, in the estimation of the University, to entitle him to that degree, and who shall, on examination, satisfy the Medical Examiners of the sufficiency of his professional knowledge; provided that the number of degrees granted in this manner shall not exceed ten in any one year.

(A proposal to modify this clause by the removal of the restriction to ten degrees in each year, and the substitution of a requirement of five years' possession of a medical or surgical degree entitling the holder to be registered under the Medical Act, instead of that compelling the candidate to be above the age of forty years, has been introduced into the University Court by Dr. Richardson, F.R.S., the Assessor of the General Council, and as it has been received with much favour by the University authorities, there is reason to believe that it will soon become law.)

The subjects of examination are:—

I. Materia Medica and Therapeutics.
II. Medical Jurisprudence.
III. Practice of Medicine and Pathology.
IV. Surgery.
V. Midwifery.

There is a further examination for Honours, part of which is conducted at the bedside of patients in a hospital.

The fee for the degree of M.D. under the present regulations is fifty guineas.

THEOLOGY.

The degrees granted in this faculty are Bachelor of Divinity (B.D.) and Doctor of Divinity (D.D.)

The Theological course, which is compulsory on candidates for the Degree of B.D., consists of Three Sessions of Theology, and Two Sessions each of Hebrew, Church History, and Biblical Criticism.

Masters of Arts of this, or of any other University, who have completed their Theological course at this University, or who have attended as regular students of Theology for one session in this University, and have completed their Theological course at any other Scottish University, may be admitted to examination for the degree of B.D., on producing satisfactory evidence to the above effect.

Masters of Arts who have given regular attendance for one session on two or more of the Theological classes of this University, and have completed a regular course of Theological study in connection with the denomination to which they belong, may be admitted to examination for the degree of B.D., on producing satisfactory evidence to that effect.

The examination may be taken at two separate periods, the first of which shall not be earlier than the close of the candidate's third Session of regular attendance.

The subjects for examination are :—

I. *a.* Christian Evidences.
   1. Theistic Principles and the Philosophy of Belief.
   2. Evidence from Miracles—Internal Evidence.
   3. Genuineness of the Gospels.

   b. Theology.
   1. The Doctrines of Sin and of the Atonement, *or*
   2. The Doctrine of the Trinity.

II. Biblical Criticism.

III. Church History.

IV. Hebrew and Oriental Languages.

The fee for the degree for B.D. is three guineas.

The degree of Doctor of Divinity is conferred without examination, *honoris causâ tantum*, on such persons as may be selected by the Senatus Academicus, for distinguished eminence.

The fee for the degree of D.D. is ten guineas.

LAW.

The only degree granted by the University in this faculty is that of Doctor of Laws (LL.D.) This is an honorary degree.

The fee for the degree of LL.D. is ten guineas.

SCIENCE.

No distinct Faculty of Science as yet exists; but the University has recently agreed to confer the degree of Doctor of Science.

The advantage also of establishing a distinct department of scientific study, embracing Physics, Chemistry, Botany, and Comparative Anatomy, for students in medicine prior to entering for purely professional study at the Hospital Schools, has been suggested to the University authorities, and is likely to receive their favourable consideration.

COLLEGES.

UNITED COLLEGE OF ST. SALVATOR AND ST. LEONARD.

PRINCIPAL—PROFESSOR J. C. SHAIRP, M.A., LL.D.

PROFESSORSHIPS IN THE FACULTIES OF ARTS AND MEDICINE.

GREEK.

PROFESSOR—LEWIS CAMPBELL, M.A.

There are three Greek Classes, which are taught daily by the Professor at separate hours.

The First or Junior Greek Class is generally attended by students of the first year. They begin with the Greek Grammar and Xenophon, and proceed afterwards to Homer and Euripides, with lessons on History, Geography, Syntax, and the Irregular Verbs, and occasional exercises in prose composition.

The summer studies between the first and second year consist chiefly of Homer, Herodotus, Euripides, revision of Grammar and Syntax, and exercises in translation and prose composition.

The Second Greek Class is generally attended by students of the second year. Their work comprises some part of Homer, Herodotus, Æschylus or Sophocles, and Thucydides, with exercises in translation and composition.

The subjects for the summer studies between the second and third year, in addition to the work for the degree, are taken from Thucydides, the Greek Dramatists, and Plato or Demosthenes, with an essay on Greek History or Literature, and exercises in translation and composition.

In the Third Class, which is open to students in either their third or fourth year, the subjects generally studied are Thucydides, Sophocles, Plato, and Pindar or Aristophanes; with occasional essays on Greek History and Literature, and regular exercises in translation and composition.

Examinations are held at intervals in each class on the subjects studied.

Fee for each course, £3 3*s*.

HUMANITY.

PROFESSOR—J. C. SHAIRP, M.A., LL.D.

There are three Humanity Classes. The First Humanity is generally attended by students in their first year; the Second Humanity by students in their second year; and the Third, which is a voluntary class, is open to students in either their third or fourth year.

In the First Humanity Class, which meets five days a-week at 12 o'clock, and on Tuesdays and Thursdays also, at 10 o'clock, the subjects of study are,—Extracts from Tibullus or Ovid, one of the later books of Virgil's Æneid, one or more of Cicero's Speeches, part of a book of Livy, and a book of the Odes or Satires of Horace. At the second hour on Tuesdays and Thursdays, Liddell's History of Rome, portions of Ramsay's Roman Antiquities, and exercises in Latin Prose (chiefly translation of passages from Liddell's History of Rome into Latin), having been prepared at home, are done in the class.

Besides the necessary work, additional books of the above-named authors are prescribed as voluntary work, in which the students are examined *vivâ voce* or in writing.

The Second Humanity Class meets five days a-week at 9 o'clock a.m. The subjects of study are,—some part of Cicero's Philippics, or one of the Verrine Orations, or the Brutus, or some other treatise of Cicero, a Georgic of Virgil, a book of the Epistles of Horace, the Agricola or Germania of Tacitus, the Satires of Juvenal. Translations from English into Latin Prose. Voluntary work is prescribed in this class also. The Professor prelects generally one day in the week on Juvenal or some other Latin author, or lectures on some linguistic subject.

Subjects for summer study are proposed at the close of each session to students who have attended the first class, and also to those who have attended the second. Examinations on these subjects are held at the opening of each ensuing session.

The Third Class meets at 11 o'clock on Monday, Wednesday, and Friday. The subjects of study are,—some of Cicero's Epistles or De Natura Deorum; some part of the Annals or Histories of Tacitus; Lucretius, Juvenal, or Plautus; Latin Prose, and occasional lectures or prelections by the Professor.

Fee for each course, £3 3*s*.

LOGIC AND METAPHYSICS.

PROFESSOR—T. S. BAYNES, LL.B.

The course of lectures consists of two parts: the first being devoted to Psychology, or the science of the facts of consciousness; and the second to Logic in its widest sense, as the science of inference necessary and probable.

The Psychological course includes an Exposition of the Senses, the Imagination, the Understanding, and the Reason, with a discussion of some of the higher metaphysical problems suggested by the psychological inquiry. The text-books for this part of the course are Reid's Essays on the Intellectual Powers, and Stewart's Elements.

The second or Logical part of the course consists of lectures on the Province of the Science, the Laws and Forms of Thought, and the Logic of Induction. The text-book for this part of the course is Whately's Logic.

Fee for the course, £3 3*s*.

CLASS OF ENGLISH LITERATURE.

PROFESSOR—T. S. BAYNES, LL.B.

The course of lectures is divided into three main branches, embracing, respectively, a history of the language, a review of the literature in its leading epochs, and an exposition of the forms and principles of literary composition. A play of Shakespeare, and one or more books of Milton's Paradise Lost, are read by the class during the session.

The text-book is Spalding's History of English Literature.

Fee for the course, £3 3*s*.

MORAL PHILOSOPHY.

PROFESSOR—R. FLINT.

Lectures are delivered daily at 1 p.m. on—The Philosophy of Man's Moral Nature; The Philosophy of Man's Moral Relations (embracing Pure, Theological, and Christian Ethics); The Philosophy of Man's Moral History; and, The History of Moral Philosophy. Students are examined each day for a short time on the lecture of the previous day. Four or five essays and four or

five examinations in writing are prescribed during the Session. Fleming's Manual of Moral Philosophy, and Bain's Mental and Moral Science (Books III., IV., Ethics, and Appendix C) are recommended as text-books.

Fee for the course, £3 3*s*.

CLASS OF POLITICAL ECONOMY.

PROFESSOR—R. FLINT.

A separate course of lectures is delivered twice a week on Political Economy, on Tuesdays and Thursdays at 3 o'clock, commencing after the Christmas holidays.

Text-Book.—Senior's Political Economy.

NATURAL PHILOSOPHY.

PROFESSOR—W. SWAN, LL.D., F.R.S.E.

The subjects of lecture are—Properties of Matter and of Force, including Inertia, Gravitation, Molecular Forces, Laws of Motion, Conservation of Energy; Dynamics or Mechanics, including Hydrostatics and Pneumatics; Sound; Heat; Light; Electricity; Astronomy; Meteorology.

The Class meets at the following hours:—10 to 11 o'clock on Tuesdays and Thursdays; 12 to 1 o'clock on five days a week; 2 to 3 o'clock on Wednesdays occasionally.

The lectures on Mondays, Wednesdays, and Fridays at 12 o'clock are copiously illustrated by experiments; and are adapted to the capacity of students who may possess only a very moderate knowledge of mathematics.

The lectures on Tuesdays and Thursdays at 12 o'clock are chiefly devoted to the discussion of such subjects as admit of strict mathematical treatment. The hours from 10 to 11 o'clock are similarly employed, and are also occasionally occupied by oral examinations on recent lectures, and in working out problems. Examinations *vivâ voce* are, however, resorted to at any time when it is thought that the subject of exposition may thereby be better elucidated. Experimental illustrations also are not confined to the three lectures a week above mentioned, but are introduced whenever they may be needed.

Examinations.—In addition to the oral examination, the class

is examined in writing, as follows, on Wednesdays from 2 to 3 o'clock :—

1. Examinations on the lectures. The questions which are put orally are usually such as admit of a short answer; no mathematics being required further than the occasional writing down of a formula from memory.

2. Examinations chiefly on applied mathematics. The subjects of examination, which are given to the class in writing, consist generally of propositions in the lectures or text-books, with the addition of a few problems.

Text-Books.—Parkinson's Mechanics; Bird and Brooke's Natural Philosophy; Ganot's Physics, by Atkinson; or Miller's Chemistry, vol. i.; Herschel's Astronomy.

The following books are also recommended for study :—Todhunter's Statics; Tait and Steele's Dynamics; Routh's Rigid Dynamics; Besant's Treatises on Hydrostatics; Newton's Principia, Evans's edition; Parkinson's Optics; Lloyd's Lectures on the Wave Theory of Light; Airy's Tract on Light; Balfour Stewart on Heat; Tait's Sketch of Thermo-Dynamics; Jamin, Cours de Physique.

Fee for the course, £3 3*s*.

MATHEMATICS.

PROFESSOR—W. L. F. FISCHER, M.A., LL.D., F.R.S.

There are three Mathematical classes.

The First or Junior Class meets one hour daily for five days in the week. The subjects are Euclid, Books I. II. III. IV. VI., and Algebra as far as Simple Equations, and including Ratio and Proportion and theory of Arithmetic.

Text-Books.—Euclid, and Todhunter's Algebra for Schools and Colleges.

The Second Class meets one hour daily for five days in the week. The subjects are,—Algebra, Plane Trigonometry, and Elements of Application of Algebra to Geometry, Trigonometry, and Conic Sections.

Text-Books.—Todhunter's Algebra and Snowball's Trigonometry.

The Third or Senior Class meets one hour daily for three days in the week. The subjects are,—Analytical Trigonometry, Analytical Conic Sections, Differential and Integral Calculus.

Text-Books.—Todhunter's Plane Co-ordinate Geometry, and his Differential Calculus.

In all the classes oral examinations are held daily, written examinations once a fortnight.

Fee for each course, £3 3*s*.

CIVIL AND NATURAL HISTORY.

PROFESSOR—W. MACDONALD, M.D., F.R.S.E.

The course of instruction comprises :—

1. Civil History and Anthropology; History of England from the Accession of the Stuart Dynasty.
2. Zoology and Comparative Anatomy; the Anatomical Zoology of the Warm-blooded Vertebralia.
3. The Anatomical Zoology of the Invertebralia.
4. Geology and Physical Geography.

These lectures and examinations are conducted with a special view to prepare candidates for the Civil, Military, and Indian Services, and for Graduation in Arts and Medicine with honours.

MEDICINE AND ANATOMY.

PROFESSOR—O. H. BELL, M.D., F.R.C.S.E.

The object of this course is to instruct the general student as well as the student of medicine in the Anatomy and Physiology of the Human Body, and in the more essential departments of Sanitary Science.

The first part of the course is occupied with a study of the healthy tissues and their functions; and the second part with the several systems of the body—*e.g.*, the *osseous*, *muscular*, *vascular*, *respiratory*, *cutaneous*, *nervous*, and *digestive* systems.

In studying the functions of these systems, special consideration is given to subjects which bear upon the hygiene of individuals and of communities—*e. g.*, *nutrition*, *growth*, *exercise*, *physical education*, *food*, *drink*, *air and water*, *clothing*, *ablutions*, *ventilation*, *drainage*, *climate*, *occupations*.

The class meets three days in the week, one day being in general devoted to written or oral examination. The lectures are illustrated by hand-preparations, wet and dry preparations, models, diagrams, microscopic demonstrations, and, where it is desirable, by Comparative Anatomy and Physiology.

Fee for the course, £3 3*s*.

CHEMISTRY.

PROFESSOR—M. F. HEDDLE, M.D.

I. *Systematic Course.*—The lectures are delivered daily at 11 a.m., and on Tuesdays and Thursdays at 3 p.m. during the College Session. They commence with the consideration of Chemical Physics, including the chemical relations of Cohesion, Adhesion, Heat, Light, and Electricity. The general principles of Chemical Philosophy, including the Atomic Theory, are then discussed. The Non-Metallic and Metallic Elements, and their compounds, are next fully treated of, together with their more important technological applications. The latter part of the course is devoted to Organic Chemistry. Each course is complete in itself, but in alternate years one or other of the last two departments is treated more *in extenso.*

Fee for the course, £3 3*s.*

II. *Laboratory.*—The Laboratory is open during the session to a limited number of students, from 10 a.m. to 3 p.m., for instruction in Chemical Analysis, and the application of Chemistry to Medicine and the Arts.

Fee, £12 12*s.* for six months.

Text-Books.—Brande and Taylor's Chemistry, Bloxam's Chemistry, Miller's Elements of Chemistry, 3 vols.

COLLEGE OF ST. MARY.

PRINCIPAL—THE VERY REV. J. TULLOCH, D.D.

PROFESSORSHIPS IN THE FACULTY OF THEOLOGY.

SYSTEMATIC THEOLOGY.

PROFESSOR—J. TULLOCH, D.D.

This Professorship is conjoined with the office of Principal.

The present law of the Church of Scotland requires that every student be enrolled by the Professor of Divinity for at least three sessions of regular or constant attendance. If the student attend only two full sessions, his course must extend to five sessions. In every case six discourses must be delivered with approbation, in order that the Professor may give such a certificate as shall warrant a Presbytery to take the student on trial for licence as a preacher of the Gospel. These discourses are,—a homily, a lecture, a popular sermon, a Hebrew exercise on a passage of the Old Testament, and a critical discourse on a passage of the New Testament.

The Professor prescribes and hears the lecture and sermon; and every student in his last session must have all his discourses delivered before the end of January should he wish to be taken on trials for licence at the close of the session.

The course of study in the two classes is as follows:—

Junior Class.—Apologetic Theology, in its several branches, forms the subject of study in this class, partly by lectures and partly by examination. The plan of the course is as follows:—

I. Introductory outline of Theological study. II. Principles of Theism. III. Christian Evidences: 1. Indirect Historical Evidence; Theories of the Origin of Christianity—Strauss—Renan. 2. Direct Historical Evidence—Miracles—Genuineness of the Gospels. 3. Internal Evidence.

Senior Class.—The doctrines of Christianity, in their substance and in their logical and historical connection, form the main subject of study in this class. The plan of the course varies according to the attendance of the student in his second or third year, but is

designed to embrace in its full outline—I. Introduction to Dogmatic Theology; Theory of Revelation; Inspiration; relation of Reason to Revelation; process of the formation of Dogma philosophically and historically considered. II. Discussions, and Readings in the Greek Testament, on the main Doctrines of Christianity: 1. The Trinity and the Incarnation; 2. Sin; 3. The Atonement; 4. The Doctrines of Grace; 5. The Church and the Sacraments. III. Some time is also given to Pastoral Theology, or the subject of preaching and the duties of the ministry.

Fee for each course, £1 11*s.* 6*d.*

DIVINITY AND BIBLICAL CRITICISM.

PROFESSOR—F. CROMBIE, M.A., D.D.

The course of instruction in this department is intended to embrace the following subjects:—

I. The Criticism of the Old Testament, including the history of the Canon, of the Text, &c. &c.; with a special examination of the objections brought against the authorship and integrity of the leading books of Old Testament Scripture.

II. The Criticism of the New Testament, treated in a corresponding manner.

III. The Principles of Hermeneutics, with a history of the various schools of interpretation.

IV. Critical and Doctrinal Exposition of portions of the Septuagint and Greek Testament.

V. The Greek Critical Exercise and Latin Exegesis are read in this class.

The course of study will occupy three Sessions.

Fee for the course £1 11*s.* 6*d.*

DIVINITY AND ECCLESIASTICAL HISTORY.

PROFESSOR—A. F. MITCHELL, D.D.

The work of the class is conducted partly by means of lectures, and partly by means of examinations on a text-book. Kurtz's History of the Christian Church is proposed to be used meantime as the text-book.

After an introductory lecture defining the subjects which are properly comprehended in the history of Christianity and the Christian Church, these subjects are divided chronologically and

topically. Chronologically they are arranged under three periods —the ancient, the medieval, and the modern: the first extending from the foundation of the Christian Church till towards the close of the seventh century, when the estrangement between the Eastern and Western Churches may be said to have commenced, and the Papal and Mohammedan powers to have been pretty firmly established; the second, extending from the close of the seventh to the earlier part of the sixteenth century, when the Reformation from Popery took place, and national Protestant Churches were established in several of the countries of Western Europe; and the third, extending from the Reformation to our own time. Topically the subjects are arranged under the following heads—viz., 1. History of the extension of Christianity; 2. History of the organisation and government of the Christian Church; 3. History of Christian doctrine; 4. History of Christian worship and life—which heads are employed as subdivisions under each of the chronological periods mentioned above, and the one division made to supplement the other.

For some years to come, the Professor proposes in his lectures to confine the attention of his students to the first and third of the above periods, devoting the first session of his course chiefly to subjects connected with the former, and the second session to subjects connected with the latter, and especially with the history, constitution, and usages of the Reformed Church of Scotland.

Subjects prescribed for Summer Study.—Neander's Church History, vols. i. and ii.; M'Crie's Life of Knox; Epistles of Clement, Polycarp, and Ignatius, in Hefele's edition of the Apostolic Fathers; and the Confessions of St. Augustine.

Fee for the course, £1 11*s.* 6*d.*

HEBREW AND ORIENTAL LANGUAGES.

PROFESSOR—J. MC GILL, LL.D.

Junior Class.—Elements of Hebrew grammar; translation of Hebrew prose; written exercises; and occasional lectures.

So long as present arrangements continue, this class will be conducted in such a manner as to admit of Arts Students of the fourth year obtaining an elementary knowledge of Hebrew by attending on Monday, Wednesday, and Friday.

Senior Class.—Translation from the Hebrew by the students on Monday, Wednesday, and Friday; lectures and expositions by the

Professor on Tuesday and Thursday; written exercises on Hebrew idioms; elements of Chaldee, Syriac, or Arabic. The books read and translated are chiefly the Prophetical and Poetical books of the Old Testament; but some portions of the Pentateuch are also read, and a few extracts in some of the cognate languages.

Private Class for Students of the Third Year.—Selected portions of the Hebrew and Chaldee Scriptures translated and explained by the Professor; also a few lectures on the Talmuds and later Jewish literature, with translation of specimens; Syriac literature; history and comparative philology of the Shemitic languages.

Text-Books.—'The Student's Hebrew Grammar;' 'The Student's Hebrew Dictionary,' or the larger Dictionaries of Fürst or Gesenius; Syriac New Testament; Roediger's Chrestomathia Syriaca; Tennant's Synopsis; Petermann's Grammatica Arabica.

Fee for the course, £1 11*s.* 6*d.*

SESSIONS.

The University Session begins about the 1st of November in each year, and ends in the last week of the following April.

The Divinity Session, or Session in St. Mary's College, terminates in the last week of March.

ENDOWMENTS.

SCHOLARSHIPS.

Number.	Title.	Duration.	Annual Value. £	s.	d.
Two ...	Ramsay ...	Four years ...	50	0	0
One ...	Guthrie ...	Four yrs., 1st year,	100	0	0
		remaining years	50	0	0
Two ...	Bruce ...	Two years ...	50	0	0

BURSARIES OPEN TO COMPETITION.

IN UNITED COLLEGE.

Number.	Title.	Duration.	Annual Value. £	s.	d.
Twenty ...	Foundation ...	Four years ...	10	0	0
Two ...	Gray ...	,, ...	10	0	0
One ...	Pyper ...	,, ...	14	0	0
Three ...	Bruce ...	Three years ...	30	0	0
Two ...	Baxter ...	Two years ...	20	0	0
Two ...	Cheape ...	Three years ...	22	0	0
Two ...	Duncan ...	Four years ...	14	0	0

IN ST. MARY'S.

Number.	Title.	Duration.	£	s.	d.
Eight ...	Foundation ...	Four years. ...	10	0	0
One ...	Yeaman ...	,, ...	7	0	0
Two ...	Alexander ...	,, ...	15	0	0
One ...	Stuart ...	,, ...	6	10	0
One ...	Wemyss ...	,, ...	25	0	0

The subjects of examination for the Scholarships and Open Bursaries are published each year in the University Calendar.

There are also sixty Bursaries attached to the two Colleges, varying in annual value from £5 to £30, in the gift of various patrons.

PRIZES.

Subject.	Title.	Value. £	s.	d.
English	Gray ...	10	0	0
Mathematics	Carstairs ...	10	0	0
,, ...	Duncan ...	14	0	0
General Scholarship ...	Miller ...	70	0	0
Logic	Bruce ...	10	0	0
Physical Science	Arnott ...	45	0	0
General Scholarship ...	Gray ...	10	0	0
Divinity—Greek and Hebrew	Cook & Macfarlan	21	0	0
General Scholarship ...	Chancellor ...	10	0	0

There are also Class Prizes and Prizes given by the different Professors for particular distinction.

The proceeds available for Bursaries, Prizes, and Scholarships in the University amount annually to about £2000.

LIBRARY.

The Library contains upwards of 100,000 volumes, including valuable encyclopædias and works of reference, editions of the classics, and the chief works of continental literature, and it is particularly rich in standard works in the departments of Natural History, Anatomy, Chemistry, and Geology. It is continually being enriched by contributions from British and foreign learned societies and from private individuals, as well as by purchases. It contains more than one hundred and fifty MSS., some of great interest and value. Among others, several Persian MSS.; a beautiful copy of the works of Augustine in vellum MS., and a volume of Ecclesiastical Styles written in the early part of the sixteenth century; an old MS. of Wintoun's Chronicle, and a remarkable collection of Foundation Bulls and Charters in excellent preservation, and greatly admired for their exquisite penmanship. The original copy of the Solemn League and Covenant containing upwards of 1600 signatures, which was subscribed at St. Andrews in 1643, is preserved here.

Every matriculated student is entitled to have in his possession two volumes at one time; to retain any book for two weeks from the date of borrowing; and further, to re-borrow any book for successive periods of two weeks, unless an application for the same has been made by another person entitled to the use of the Library.

The Library is open during the winter session for the exchange of books on Monday, Wednesday, and Friday from ten to one, and from two to four o'clock. At the same hours there is a large Consulting Room open to students, where books may be fully studied.

There are also libraries in connection with, and containing books having special reference to the subjects of, the classes of Moral Philosophy, Logic, Chemistry, and Humanity, to which new books are added from time to time.

The St. Andrews Students' Missionary Society possesses a Library, consisting chiefly of books bearing on Missions and Missionary work, and frequent additions are made to it by grants from the funds of the Society. It is managed by one of the members of the Society, who is chosen annually.

MUSEUM.

The Museum was originally intended to be a merely local collection, and is particularly rich in specimens illustrating the Fauna of the district, but from the numerous donations received from many sources it has assumed the character of a general museum, in which students may study nearly all the chief departments of Natural History, Geology, and Mineralogy.

The Museum occupies two apartments in the United College, the larger of which contains a general collection, including minerals and rocks; fossils arranged in stratigraphical series; anatomical preparations; animals; birds; fishes; reptiles; crustaceans; shells; plants; coins; and objects of antiquity, local and foreign.

The chief objects of local interest are, a number of cinerary urns found in the neighbourhood of St. Andrews, and in other parts of Fifeshire; human skulls recovered from ancient burying places near St. Andrews; and a large collection of fishes from the famous fossil beds of Dura Den.

In the lobby are several carved stones of archæological interest; and in the upper hall there is a collection of specimens illustrating the natural history of the district round St. Andrews.

The Museum is freely open to students for the purposes of study.

SOCIETIES.

DEBATING SOCIETIES.

There are two debating societies—"The Literary" and "The Classical"—in connection with the United College, and almost all the students are members of one or other of them. These are voluntary associations formed by the students themselves, and the members are allowed the use of rooms within the College. The aim of both societies is to give opportunity for the practice of public speaking. The meetings are held every Saturday evening during the session, when the members in turn read essays, which are freely criticised by those present; and a question relating to history, literature, or science is discussed and voted on. The two societies are also in the habit of occasionally meeting together for the purpose of conducting their debates. Honorary members are elected at the close of each session in both societies.

MISSIONARY SOCIETY.

This Society, instituted in 1824, has for its objects the spread of the knowledge of the Gospel abroad, and the infusion of a missionary spirit among its members at home. It is open to all members of the University, who pay a small entrance-fee. It meets in St. Mary's College every Saturday morning at 10 o'clock, and devotes its meetings to religious exercises and business alternately.

THEOLOGICAL SOCIETY.

This Society was instituted in 1760. It is composed exclusively of Divinity students; and has for its objects the discussion and treatment of the deeper and more important questions of theology and religion. It meets in St. Mary's College every Saturday evening during the Divinity session, between the hours of seven and nine.

STUDENTS.

Every student is required to matriculate at the commencement of the session before he can be enrolled in any class of the University. The fee for each academical year is £1. Matriculated students have the right of admission to the University Library, and, on certain conditions, to the Museum of Natural History. They also have the privilege of electing, by a general poll, the Rector of the University.

No student in the Faculty of Arts is held to have completed a College session, who has not attended in the said session at least two classes, one of which shall be a class required for graduation, in terms of the University regulations.

The following are the Laws and Regulations of the Colleges:—

UNITED COLLEGE.

Students shall attend Divine Service regularly, either in the College Church or in any other place of worship selected by themselves or their guardians. They are required to state to the College Clerk on taking out their tickets what Church they mean to attend, in order that the regularity of their attendance may be ascertained.

Students shall wear their gowns within the College.

Students shall give regular and punctual attendance on their classes, and shall observe due order and discipline.

Profane swearing, intemperance, drinking in inns or taverns, riotous or disorderly behaviour, and all acts of immorality, are strictly prohibited, and on detection will be severely punished.

Violations of the laws and regulations of the College, as well as all immorality, and conduct unworthy of a student and gentleman, will be visited by censure, or such other penalty as shall be deemed suitable to the offence; and in the case of aggravated misconduct, by rustication, which involves the loss of one or more sessions, or by expulsion from the College, which prevents admission to any University in Scotland.

Bursars, in cases of flagrant misconduct, or continued neglect of their studies, will be deprived of their bursaries.

All class fees shall be paid to the Clerk of the College at the commencement of the session; and each student is required to lodge his address in St. Andrews with the Janitor.

ST. MARY'S COLLEGE.

The Principal and Masters require the students in Divinity to be regular in attending the prelections of their teachers, and the exhibitions of their fellow-students.

They require that if a student shall on any occasion be necessarily detained from a class, he shall satisfy the Master by whom it is taught that his absence has been unavoidable; and that no student shall be absent from any other part of his duty, without the leave of the Principal.

They wish it to be particularly understood by every student holding a Bursary, that irregular attendance in any of the classes, or on any part of his duty, besides all other consequences, must be necessarily followed by the forfeiture of his claim to the emoluments of his Bursary.

They enjoin students to attend public worship.

They appoint that prayers shall be said every morning in the Hall; the students officiate in rotation.

RESIDENCE, BOARD, &c.

There are many highly respectable houses where students may lodge, and may either provide themselves, or be boarded at a fixed sum. The rent of lodging is from five shillings to seven shillings and sixpence per week, according to the accommodation afforded.

The cost of living may be calculated at from ten to fifteen shillings per week.

ST. LEONARD'S COLLEGE HALL.

WARDEN—J. B. HASLAM, M.A., FELLOW OF ST. JOHN'S COLL., CAMB.

The main design of this institution, as expressed in the original prospectus, is "to combine domestic comfort and superintendence, with moral and religious training, and the best possible aids to study, for young men attending the University." The Hall was first opened in 1861 in the houses which now occupy the site of the old College of St. Leonard, one of which is still pointed out as having been the residence of George Buchanan. After it had continued for seven years in this situation, a larger and more commodious building was erected on a beautiful site in the old College garden, adjoining the ancient College and Chapel of St. Leonard. The House is capable of accommodating upwards of thirty students. The entire control of the institution is committed to the Warden, who superintends the conduct and studies of the students, and, along with a resident Tutor, assists them in Classics, Mathematics, and Mental Philosophy. Within the Hall the College system, which prevailed formerly in Scotland, and is still maintained in most of the Colleges of the English Universities, is again restored. The habits of family life are preserved; all the meals, and not merely dinner, are taken in common; and morning and evening prayers are conducted by the Warden. The new Hall, standing as it does within the precincts of St. Leonard's, is, as it were, built on the old foundation, and may be regarded not as a novelty but as a restoration, attaching itself to all the traditions of the past.

The charge for board, &c., during the session, is from £60 to £70, according to the accommodation required.

The Hall is opened in the summer for May, June, and July, during which time, as the College classes are then closed, the work done is chiefly preparatory for the winter session, and is conducted by the Warden and Tutor, with such other assistance as is required. The charge for the summer session is from £30 to £35.

DEGREES.

SCHEME OF STUDY FOR THE DEGREE OF M.A.

I.—For those who do not pass the Preliminary Examination.

FIRST SESSION.

Classes.	Hours.	Fees. £	s.	d.
Humanity...	... 10 a.m. Tues. & Thurs....			
,, ...	... 12 noon daily	3	3	0
English Literature	... 10 a.m., Mon., Wed., & Fri.	1	1	0
Mathematics	... 11 a.m. daily	3	3	0
Greek ...	... 1 p.m. daily	3	3	0

SECOND SESSION.

Humanity...	... 9 a.m. daily	3	3	0
Greek ...	... 10 a.m. daily	3	3	0
Mathematics	... 12 noon daily	3	3	0
Logic ...	... 1 p.m. daily	3	3	0

THIRD SESSION.

Moral Philosophy & Political Economy	1 p.m. daily, and ... 3 p.m. Tues. & Thurs. ...	3	3	0

FOURTH SESSION.

Natural Philosophy	... 10 a.m. Tues. & Thurs. ...			
,,	... 12 noon daily, and ...			
,,	... 2 p.m. Wed. occasionally.	3	3	0
Chemistry...	... 11 a.m. daily, and ...			
,, ...	... 3 p.m. Tues. & Wed. ...	3	3	0

Fees for Classes	£32	11	0
Matriculation Fees	4	0	0
Examination Fees	3	3	0
Total cost of M.A. Degree	£39	14	0

II.—For those who pass the Preliminary Examination.

FIRST SESSION.

Classes.	Hours.	Fees. £	s.	d.
Humanity...	... 10 a.m. Tues. & Thurs. ...			
,, ...	... 12 noon daily	3	3	0
English Literature	... 10 a.m. Mon., Wed., & Fri.	1	1	0
Mathematics	... 11 a.m. daily	3	3	0
Greek ...	... 1 p.m. daily	3	3	0
SECOND SESSION.				
Humanity...	... 9 a.m. daily	3	3	0
Greek ...	... 10 a.m. daily	3	3	0
Mathematics	... 12 noon daily	3	3	0
Logic ...	... 1 p.m. daily	3	3	0
THIRD SESSION.				
Moral Philosophy & Political Economy	1 p.m. daily, and ... 3 p.m. Tues. & Thurs. ...	3	3	0
Natural Philosophy	... 10 a.m. Tues. & Thurs. ...			
,,	... 12 noon daily, and ...			
,,	... 2 p.m. Wed. occasionally.	3	3	0
Chemistry...	... 11 a.m. daily, and ...			
,, ...	... 3 p.m. Tues. & Wed. ...	3	3	0
Fees for Classes ...	... ...	£32	11	0
Matriculation Fees ...	... ...	3	0	0
Examination Fees ...	... ...	3	3	0
Total cost of M.A. Degree	... ...	£38	14	0

The above is the order in which the University authorities advise that the classes required for the M.A. degree should be attended by students who spend four years in the University.

Though Moral Philosophy is the only subject absolutely required in the third session, the student, if he wishes it, may attend the classes of Humanity, Greek, and Mathematics.

The age at which students usually commence their attendance

on classes at the University is fifteen or sixteen, so that the necessary examinations may all be passed at or before the age of nineteen.

The Degree of Master of Arts may be conferred at the annual public ceremony of Graduation as soon as the student has passed the requisite examinations, but the Graduate cannot become a Member of the General Council until he has attained the age of twenty-one years.

SCHEME OF STUDY FOR THE DEGREE OF B.D.

FIRST SESSION.

Classes.	Hours.	£	s.	d.
Apologetic Theology* or Christian Evidences	9 a.m. daily	1	11	6
Hebrew	10 a.m. daily	1	11	6
Church History ...	12 a.m. daily	1	11	6

SECOND SESSION.

		£	s.	d.
SystematicTheologyor Christian Doctrines	10 a.m. daily	1	11	6
Biblical Criticism ...	1 p.m. daily	1	11	6
Hebrew	11 a.m. daily	1	11	6

THIRD SESSION.

		£	s.	d.
Systematic Theology...	10 a.m. daily	1	11	6
Biblical Criticism ...	1 p.m. daily	1	11	6
Church History ...	12 noon daily	1	11	6

	£	s.	d.
Fees for Classes required for B.D. ...	£14	3	6
Matriculation Fees	3	0	0
Examination Fees	3	3	0
Total cost of Degree of B.D.	£20	6	6

Candidates for the Degree of B.D. are required to attend three sessions of Divinity or Systematic Theology and two sessions of Biblical Criticism, Church History, and Hebrew respectively. The order of attendance on the classes is not absolutely fixed, but the above is recommended as a suitable plan.

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* Apologetic Theology is the initial department of Systematic Theology for students of the first year.

SCHEME OF STUDY FOR THE DEGREES OF M.A. & B.D. COMBINED.

Preliminary Examination to be passed.

Classes.	Hours.	Fees. £	s.	d.
FIRST SESSION.				
Humanity...	... 9 a.m. daily	3	3	0
Greek ...	... 10 a.m. daily	3	3	0
Mathematics	... 12 noon daily	3	3	0
Logic ...	... 1 p.m. daily	3	3	0
SECOND SESSION.				
Humanity...	... 11 a.m. Mon., Wed., & Fri.	3	3	0
Greek ...	... 9 a.m. daily	3	3	0
English Literature	... 10 a.m. Mon., Wed., & Fri.	1	1	0
Moral Philosophy	... 1 p.m. daily, and ...			
,,	... 3 p.m. Tues. & Thurs. ...	3	3	0
THIRD SESSION.				
Natural Philosophy	... 10 a.m. Tues. & Thurs., and			
,,	... 12 noon daily	3	3	0
Chemistry...	... 11 a.m. daily, and ...			
,, ...	... 3 p.m. Tues. & Wed. ...	3	3	0
Mathematics	... 2 p.m. Mon., Wed., & Fri.	3	3	0
Apologetic Theology...	9 a.m. daily	1	11	6
FOURTH SESSION.				
Systematic Theology...	9 a.m. daily	1	11	6
Biblical Criticism	... 1 p.m. daily	1	11	6
Hebrew ...	... 10 a.m. daily	1	11	6
Church History	... 12 a.m. daily	1	11	6
FIFTH SESSION.				
Systematic Theology...	10 a.m. daily	1	11	6
Biblical Criticism	... 1 p.m. daily	1	11	6
Church History	... 12 noon daily	1	11	6
Hebrew ...	... 11 a.m. daily	1	11	6
Fees for Classes for M.A. and B.D.	...	£48	13	6
Matriculation Fees ...	... ...	5	0	0
Examination Fees ...	... ...	6	6	0
Total cost of M.A. and B.D. Degrees	...	£59	19	6

The examinations for the three separate subjects for M.A. being taken at three separate times, the subjects marked I. and II. in section "Arts" may be completed in the first two years; III. may be completed in the third year, at which time also the Theological classes for the B.D. may be begun.

SCHEME OF STUDY FOR M.A. AND ONE YEAR OF MEDICAL STUDY.

I.—For those who are not able to pass the Preliminary Examination, and consequently require Four Years of Study.

Classes.	Hours.	£	s.	d.
FIRST SESSION.				
Humanity...	... 10 a.m. Tues. & Thurs. ...	3	3	0
Greek ...	... 1 p.m. daily	3	3	0
Mathematics	... 11 a.m. daily	3	3	0
SECOND SESSION.				
Humanity...	... 9 a.m. daily	3	3	0
Greek ...	... 10 a.m. daily	3	3	0
Mathematics	... 12 noon daily	3	3	0
THIRD SESSION.				
Natural Philosophy	... 10 a.m. Tues. & Thurs. ...			
,,	... 12 noon daily, and ...			
,,	... 2 p.m. Wed. occasionally	3	3	0
Greek (optional)	... ...			
Latin (optional)	... ...			
Mathematics (optional)	... ...			
Logic ...	... 1 p.m. daily	3	3	0
English Literature	... 10 a.m. Mon., Wed., & Fri.	1	1	0
FOURTH SESSION.				
Moral Philosophy & Political Economy	1 p.m. daily, and 3 p.m. Tues. & Thurs. ...	3	3	0
Chemistry...	... 11 a.m. daily, and ...			
,, ...	... 3 p.m. Tues. & Thurs. ...	3	3	0
Botany (not yet arranged for)	... ...			
Anatomy & Physiology	4 p.m. daily	3	3	0
Fees for Classes		£33	12	0
Matriculation Fees		4	0	0
Examination Fees		3	3	0
Cost of M.A. Degree, and One Year of Medical Study		£40	15	0

Students of this class should pass the examinations I. and II. in the section "Arts" at the end of the second or third session, for reasons stated below. If the examinations are not passed at the end of the second session the student may well attend an extra course of Latin, Greek, and Mathematics during the third session.

II.—For those who pass the Preliminary Examination.

Classes.	Hours.	Fees. £	s.	d.
FIRST SESSION.				
Humanity...	... 10 a.m. Tues. & Thurs. ...	3	3	0
Greek ...	... 1 p.m. daily	3	3	0
Mathematics	... 11 a.m. daily	3	3	0
English Literature	... 10 a.m. Mon., Wed., & Fri.	1	1	0
SECOND SESSION.				
Humanity...	... 9 a.m. daily	3	3	0
Greek ...	... 10 a.m. daily	3	3	0
Mathematics	... 12 noon daily... ...	3	3	0
Logic ...	... 1 p.m. daily	3	3	0
THIRD SESSION.				
Moral Philosophy & Political Economy	1 p.m. daily, and ... 3 p.m. Tues. and Thurs....	3	3	0
Natural Philosophy ..	10 a.m. Tues. and Thurs....			
,,	... 12 noon daily, and ...			
,,	... 2 p.m. Wed. occasionally .	3	3	0
Chemistry...	... 11 a.m. daily, and ...			
,, ...	... 3 p.m. Tues. and Wed....	3	3	0
Anatomy & Physiology	4 p.m. daily	3	3	0
Botany (not yet arranged for)	... ...			
Fees for Classes	...	£33	12	0
Matriculation Fees	...	3	0	0
Examination Fees	...	3	3	0
Cost of M.A. Degree, and One Year of Medical Study		£39	15	0

Students of this class should pass the examinations I. and II. in section "Arts" at the end of the second session.

An essential of these schemes is that the examinations in classes I. and II. under section "Arts" should be passed before the com-

mencement of the last session, because the first year of professional study cannot be commenced until the preliminary examination in Classics and Mathematics has been passed. These examinations being admitted by the medical authorities as sufficient evidence of the necessary preliminary education, the student may then in his last session, in addition to preparing for the third part of the examination for M.A., viz. Moral Philosophy and Logic,—III. in section "Arts,"—attend also such classes as will enable him to count this as one year of the four of professional study now required.

A student entering at fifteen years of age may thus pass all the examinations for the Degree of M.A., and at the same time complete one year of professional study, by the age of eighteen or nineteen. Three years more of medical study only being needed, he may at twenty-one or twenty-two be able to offer himself for his medical examination at the Colleges of Physicians or Surgeons.

The foregoing sketch of the plan of education pursued in the University of St. Andrews, and its applicability to the requirements of the Medical Authorities, has been submitted to the Very Rev. the Vice-Chancellor, Dr. Tulloch, and has received his approval.

LEONARD W. SEDGWICK, M.D.

INDEX.

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